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THE TREATMENT OF PLEURISY WITH EFFUSION.

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I wish to call attention to the propriety of treating cases of pleurisy with effusion by aspiration alone, and not by medicine.

The ordinary practice at the present time is to resort to aspiration when the effusion becomes large or if it resists the ordinary methods of treatment.

I believe that aspiration is to be used not simply to remove fluid from the chest, but to cure pleurisy as a morbid process. This means that as aspiration is the treatment of the pleurisy, it is to be performed as soon as the presence of fluid in the chest is made out.

When I began to practice medicine, in 1866, the routine treatment was to give iodide of potash internally and to apply repeated blisters over the affected side of the chest. When the chest was extremely distended the fluid was drawn off with a trocar and canula. The patients, as a rule, did not die, but they were sick for a long time. The extensive pleuritic adhesions and the long-continued compression of the lung left the patients liable to interstitial pneumonia and tuberculous inflammations of the lung.

As late as 1881 I taught as follows: "In those cases in which the invasion of the disease is acute the treatment varies according to the rational symptoms. If the patient is strong and robust, as a rule considerable relief may be afforded by applying wet cups over the affected side of the thorax. If the patient is not strong and vigorous, dry cups or blisters may be used. To relieve the pain and diminish the fever, opium, aconite, and liquor ammoniæ acetatis are given. After the acute symptoms have subsided, the question of getting rid of the fluid in the thoracic cavity comes up.

"In those cases in which the invasion is insidious there are two indications to be met. In the first place, the fluid should be removed from the pleural cavity, and in the second place the nutrition of the patient must be improved. The exact way in which these cases of subacute pleurisy are to be treated depends on the general condition of the patient. If his nutrition has not suffered up to the time he comes under treatment, your attention should be principally directed to the removal of the fluid by means of persistent irritation of the skin of the chest by blisters and by the internal use of the iodide or acetate of potash. If, however, when the patient comes under observation his nutrition is impaired, and he is emaciated and anæmic, less attention should be paid to the fluid in the pleural cavity. The principal effort should be directed to the improvement of his general health. Such a patient will not bear blisters, nor can his condition be improved by the use of diuretics. Iron, quinine, and the mineral acids should be administered, together with cod-liver oil or cream. It may be necessary to send the patient to a warm climate.

"Besides these means of treatment, the question of the mechanical removal of the fluid from the pleural cavity presents itself. In regard to the advisability of aspirating the thorax there is still a considerable difference of opinion in the profession. It is, however, generally agreed that when the dyspnœa is so great as to threaten the life of the patient, and when the fluid in the pleura does not diminish within a reasonable length of time, it is expedient to perform the operation. The reasons given for not aspirating are: That in a considerable number of cases a single aspiration is of very little service, for after the fluid has been drawn off it will reaccumulate, and other aspirations are necessary; that with a number of aspirations there is danger of purulent infection; that a number of sudden deaths have occurred within twenty-four hours after aspiration."

Such a plan of treatment as is outlined above is still followed by many. It has been somewhat modified by the "thirst cure" and by the use of the salicylate of soda. The radical objection to this plan is the intolerable length of time during which the patient remains sick. Deaths, indeed, are few; but two months is an ordinary duration, and six months is not uncommon. Still further than this, the longer the pleurisy lasts and the longer the lung is compressed the greater is the extent of the pleuritic adhesions and the greater the vulnerability of the lung to tuberculous inflammation.

As time has gone on I have been so thoroughly impressed with the idea that aspiration is the only treatment needed for pleurisy with effusion that I have thought it worth while to tabulate 200 ordinary hospital cases of pleurisy with effusion occurring from the years 1886 to 1901.

CASES OF PLEURISY WITH EFFUSION TREATED BY ASPIRATION AT THE ROOSEVELT HOSPITAL, FROM 1886 TO 1901.

No.	Age	Condition of the chest on admission.	Day tapped.	Character of the fluid.	Subsequent tappings.	Other treatment.	No. of days from first tapping to end of pleurisy.
1	28	Left chest two-thirds full of fluid.	28th day	Reddish serum 1600 c.c.	None.	Acetate of potash and digitalis, calomel, squills, and digitalin; strapping the chest.	38 days.
2	45	Half full of fluid.	15th "	Clear serum 1400 c.c.	"	Calomel, squills, and digitalin.	8 "
3	36	Left chest two-thirds full of fluid.	120th "	Clear serum 1500 c.c.	"	None.	Went home on 9th day with chest still holding a little fluid.
4	30	Left chest three-fourths full of fluid.	60th "	Clear serum 2000 c.c.	"	Digitalin.	14 days.
5	34	Left chest three-fourths full of fluid.	16th "	Clear serum 3000 c.c.	"	None.	14 "
6	18	Left chest full of fluid.	60th "	Clear serum 1800 c.c.	One 400 c.c.	"	24 "
7	46	Right chest half full of fluid.	35th "	Clear serum three pints.	One 975 c.c.	"	13 "
8	33	Right chest three-fourths full of fluid.	9th "	Dark serum 3000 c.c.	None.	"	14 "
9	57	Left chest two-thirds full of fluid.	21st "	Clear serum 1900 c.c.	"	Digitalin.	7 "
10	23	Left chest half full of fluid.	14th "	Clear serum 1000 c.c.	"	"	6 "
11	27	Left chest full of fluid.	35th "	Reddish ser. 3150 c.c.	"	"	20 "
12	22	Right chest full of fluid.	90th "	Clear serum 24 ounces.	"	"	19 days; improved.
13	31	Left chest full of fluid.	12th "	Dark red ser. 3875 c.c.	"	"	30 days.
14	51	Right chest half full of fluid.	8th "	Clear serum 2100 c.c.	"	Potassium iodide.	14 "
15	32	Left chest half full of fluid.	14th "	Clear serum 825 c.c.	"	None.	6 "
16	25	Right chest half full of fluid.	30th "	Clear serum 1750 c.c.	"	Sodium salicylate; strapping the chest.	5 "
17	8	Right chest two-thirds full of fluid.	14th "	Reddish ser. 4 ounces.	"	None.	16 "
18	23	Right chest two-thirds full of fluid.	12th "	Clear serum 2400 c.c.	"	Digitalin, diuretic pills.	4 "
19	31	Right chest half full of fluid.	14th "	Clear serum 1050 c.c.	Bloody ser. 200 c.c.	Digitalis, squills, strychnia; strapping the chest.	26 "
20	28	Left chest half full of fluid.	42d "	Clear serum 300 c.c.	None.	Digitalin.	7 "
21	33	Left chest full of fluid.	28th "	Brown ser. 3200 c.c.	"	None.	16 "
22	25	Left chest half full of fluid.	14th "	Clear serum 2000 c.c.	"	"	10 "
23	50	Right chest half full of fluid.	28th "	Clear serum 750 c.c.	800 c.c. 90 c c. 575 c.c.	Digitalin.	43 "
24	42	Left chest full of fluid.	14th "	Clear serum 2000 c c.	None.	None.	3 "
25	41	Left chest one-third full of fluid.	14th "	Clear serum 1200 c.c.	"	Digitalis, squills, and strychnia.	6 "
26	27	Right chest half full of fluid.	14th "	Clear serum 800 c.c.	"	"	7 "
27	27	Right chest one-third full of fluid.	21st "	Clear serum 1020 c.c.	"	Strapping the chest.	5 "

No.	Age	Condition of the chest on admission.	Day tapped.	Character of the fluid.	Subsequent tappings.	Other treatment.	No. of days from first tapping to end of pleurisy.
28	25	Left chest half full of fluid.	21st day	Bloody ser. 850 c.c.	None.	None.	18 days; improved.
29	35	Right chest half full of fluid.	28th "	Clear serum 900 c.c.	"	Diuretic pill.	8 days.
30	24	Left chest full of fluid.	19th "	Clear serum 1200 c.c.	"	None.	11 "
31	24	Left chest half full of fluid.	7th "	Clear serum 1650 c.c.	"	Diuretic pill.	5 "
32	34	Right chest one-third full of fluid.	90th "	Turbid ser. 850 c.c.	"	Potassium iodide.	11 "
33	36	Right chest half full of fluid.	60th "	Turbid ser. 38 ounces.	"	Potassium iodide.	12 "
34	31	Right chest half full of fluid.	42d "	Clear serum 1400 c.c.	"	Potassium iodide.	10 "
35	13	Right chest two-thirds full of fluid	21st "	Clear serum 800 c.c.	Clear serum 1300 c.c.	Potassium iodide.	29 "
36	51	Left chest three-fourths full of fluid.	28th "	Clear serum 1900 c.c.	Clear serum 1750 c.c.	Digitalin.	24 "
37	26	Right chest half full of fluid.	6th "	Clear serum 750 c.c.	None.	"	9 "
38	34	Right chest half full of fluid.	90th "	Clear serum 525 c.c.	"	Potassium iodide.	9 "
39	24	Left chest two-thirds full of fluid.	14th "	Clear serum.	"	Potassium iodide.	11 "
40	30	Right chest two-thirds full of fluid.	75th "	Clear serum 1675 c.c.	"	Potassium acetate and digitalis.	18 "
41	17	Left chest half full of fluid.	18th "	Reddish ser. 900 c.c.	"	Potassium acetate and digitalis.	12 "
42	24	Left chest half full of fluid.	21st "	Clear serum 300 c.c.	"	Potassium acetate and digitalis.	11 "
43	26	Left chest three-fourths full of fluid.	60th "	Reddish ser. 300 c.c.	"	Potassium acetate and digitalis.	28 "
44	34	Right chest three-fourths full of fluid.	14th "	Clear serum 1075 c.c.	"	Diuretic pill.	13 "
45	19	Left chest three-fourths full of fluid.	10th "	Clear serum 1575 c.c.	"	None.	9 "
46	20	Left chest full of fluid.	4th "	Reddish ser. 250 c.c.	"	Potassium iodide.	11 "
47	22	Left chest three-fourths full of fluid.	12th "	Clear serum 2000 c.c.	"	Potassium iodide.	10 "
48	18	Left chest half full of fluid.	13th "	Clear serum 200 c.c.	"	Potassium acetate and digitalis.	8 "
49	23	Left chest half full of fluid.	28th "	Turbid ser. 1400 c.c.	"	None.	15 "
50	50	Right chest half full of fluid.	8th "	Clear serum 575 c.c.	"	Potassium iodide.	4 "
51	57	Left chest half full of fluid.	28th "	Reddish ser. 1600 c.c.	"	Potassium iodide and digitalis.	13 "
52	32	Right chest two-thirds full of fluid.	26th "	Clear serum 1825 c.c.	"	Potassium iodide and digitalis.	4 "
53	30	Right chest two-thirds full of fluid.	14th "	Reddish ser. 1100 c.c.	"	Potassium acetate and digitalis.	26 "
54	53	Left chest two-thirds full of fluid.	42d "	Clear serum 250 c.c.	Clear serum 250 c.c.	Digitalin.	38 days; improved.
55	29	Left chest half full of fluid.	14th "	Clear serum 1300 c.c.	None.	None.	14 days.
56	45	Left chest full of fluid.	8th "	Clear serum 3700 c.c.	"	"	9 "
57	32	Left chest full of fluid.	14th "	Clear serum 375 c.c.	Clear serum 800 c.c.	"	39 "
58	22	Left chest half full of fluid.	30th "	Turbid ser. 700 c.c.	None.	Digitalin.	27 "
59	63	Right chest half full of fluid.	21st "	Clear serum 1000 c.c.	"	None.	16 "
60	30	Right chest full of fluid.	7th "	Clear serum 2000 c.c.	"	Potassium iodide and digitalis.	17 "

No.	Age	Condition of the chest on admission.	Day tapped.	Character of the fluid.	Subsequent tappings.	Other treatment.	No. of days from first tapping to end of pleurisy.
61	40	Left chest three-fourths full of fluid.	90th day	Clear serum 2200 c.c.	None.	Potassium iodide and digitalis.	6 days.
62	8	Left chest half full of fluid.	3d "	Clear serum 675 c.c.	"	Potassium iodide and digitalis.	13 "
63	20	Left chest half full of fluid.	7th "	Clear serum 700 c.c.	"	None.	11 "
64	30	Right chest full of fluid.	7th "	Clear serum 1700 c.c.	600 c.c. 500 c.c.	"	16 "
65	24	Left chest half full of fluid.	21st "	Turbid ser. 250 c.c.	None.	"	9 "
66	22	Left chest half full of fluid.	16th "	Clear serum 1250 c.c.	1250 c.c. 750 c.c.	Potassium iodide and digitalis.	42 "
67	33	Right chest full of fluid.	42d "	Clear serum 900 c.c.	None.	Digitalin.	9 "
68	20	Left chest full of fluid.	14th "	Clear serum 1900 c.c.	800 c.c	None.	9 "
69	33	Left chest three-fourths full of fluid.	7th mo.	Clear serum 1250 c.c.	None.	Digitalin.	12 "
70	50	Left chest full of fluid.	30th day	Clear serum 1725 c.c.	Clear serum 2050 c.c.	"	42 "
71	48	Left chest two-thirds full of fluid.	6th "	Clear serum 1100 c.c.	None.	"	16 "
72	26	Left chest three-fourths full of fluid.	14th "	Bloody ser. 800 c.c.	"	None.	14 "
73	39	Left chest full of fluid.	4th "	Clear serum 1300 c.c.	1500 c.c.	Digitalin.	10 "
74	19	Right chest two-thirds full of fluid.	12th "	Clear serum 1400 c.c.	None.	Diuretic pill.	15 "
75	47	Left chest half full of fluid.	15th "	Clear serum 375 c.c.	1200 c.c.	Potassium iodide and diuret. pill.	38 days: not improved.
76	29	Right chest full of fluid.	14th "	Clear serum 2100 c.c.	None.	Diuretic pill.	9 days.
77	29	Right chest half full of fluid.	1st "	Clear serum 270 c.c.	"	Diuretic pill.	8 "
78	35	Left chest half full of fluid.	10th "	Bloody ser. 2 ounces.	"	Diuretic pill.	6 "
79	36	Right chest half full of fluid.	21st "	Clear serum 850 c.c.	"	Diuretic pill.	13 "
80	22	Left chest half full of fluid.	10th "	Clear serum 24 ounces.	"	None.	12 "
81	18	Left chest half full of fluid.	49th "	Clear serum 435 c.c.	"	Diuretic pill.	11 "
82	29	Left chest half full of fluid.	21st "	Clear serum 30 ounces.	"	Diuretic pill.	17 "
83	42	Left chest full of fluid.	10th "	Bloody ser. 1800 c.c.	1950 c.c. 1500 c.c. 50 c.c.	None.	43 "
84	45	Right chest three-fourths full of fluid.	15th "	Purulent ser. 2200 c.c.	Turbid ser. 500 c.c.	"	12 "
85	27	Left chest half full of fluid.	11th "	Turbid ser. 950 c.c.	None.	"	5 "
86	30	Left chest half full of fluid.	22d "	Bloody ser. 850 c.c.	"	"	8 "
87	48	Left chest half full of fluid.	18th "	Clear serum 320 c.c.	"	"	4 "
88	50	Right chest half full of fluid.	22d "	Clear serum 1600 c.c.	"	"	6 "
89	47	Right chest two-thirds full of fluid.	16th "	Clear serum 2750 c.c.	"	"	11 "
90	29	Left chest full of fluid.	14th "	Clear serum 2200 c.c.	225 c.c.	"	15 "
91	17	Left chest half full of fluid.	22d "	Clear serum 1500 c.c.	None.	"	5 "
92	47	Right chest half full of fluid.	9th "	Clear serum 1500 c.c.	"	"	7 "
93	38	Right chest three-fourths full of fluid.	37th "	Clear serum 1640 c.c.	"	"	10 "
94	48	Left chest half full of fluid.	30th "	Turbid ser. 1600 c.c.	"	"	8 "
95	32	Left chest half full of fluid.	11th "	Clear serum 1100 c.c.	"	"	8 "
96	21	Left chest two-thirds full of fluid.	29th "	Clear serum 700 c.c.	"	"	6 "

No.	Age	Condition of the chest on admission.	Day tapped.	Character of the fluid.	Subsequent tappings.	Other treatment.	No. of days from first tapping to end of pleurisy.
97	49	Left chest half full of fluid.	16th day	Clear serum 850 c.c.	None.	None.	3 days.
98	28	Left chest two-thirds full of fluid.	16th "	Clear serum 1300 c.c.	"	"	4 "
99	25	Left chest three-fourths full of fluid.	19th "	Clear serum 2250 c.c.	"	"	3 "
100	29	Right chest full of fluid.	16th "	Clear serum 2700 c.c.	"	"	9 "
101	19	Left chest full of fluid.	60th "	Clear serum 400 c.c.	"	"	10 "
102	32	Left chest full of fluid.	21st "	Clear serum 800 c.c.	"	"	15 "
103	21	Right chest half full of fluid.	50th "	Clear serum 800 c.c.	"	"	6 "
104	24	Left chest half full of fluid.	11th "	Clear serum 1200 c.c.	Clear serum 1200 c.c.	"	12 "
105	40	Left chest half full of fluid.	60th "	Clear serum 1200 c.c.	Clear serum 1000 c.c.	"	12 "
106	55	Right chest half full of fluid.	19th "	Clear serum 1500 c.c.	Bloody ser. 100 c.c.	"	6 "
107	39	Right chest half full of fluid.	50th "	Clear serum 1400 c.c.	Clear serum 1000 c.c.	"	9 "
108	21	Left chest two-thirds full of fluid.	43d "	Clear serum 950 c.c.	Clear serum 950 c.c.	"	13 "
109	39	Left chest one-third full of fluid.	90th "	Clear serum 500 c.c.	Clear serum 25 c.c.	"	6 "
110	48	Left chest one-third full of fluid.	90th "	Clear serum 800 c.c.	None	"	4 "
111	27	Right chest two-thirds full of fluid.	28th "	Clear serum 900 c.c.	"	"	3 "
112	22	Left chest one-third full of fluid.	46th "	Clear serum 600 c.c.	"	"	10 days; improved.
113	26	Left chest one third full of fluid.	60th "	Bloody ser. 1000 c.c.	"	"	10 days.
114	23	Right chest half full of fluid.	13th "	Clear serum 900 c.c.	Clear serum 300 c.c.	"	9 "
115	16	Left chest full of fluid.	28th "	Clear serum 1100 c.c.	Clear serum 100 c.c.	"	6 "
116	37	Left chest half full of fluid.	11th "	Bloody ser. 100 c.c.	None.	"	Discharged improved.
117	38	Left chest half full of fluid.	15th "	Clear serum 1300 c.c.	Clear serum 750 c.c.	"	28 days.
118	24	Right chest half full of fluid.	30th "	Clear serum 250 c.c.	None.	"	7 "
119	18	Right chest half full of fluid.	6th "	Clear serum 900 c.c.	Clear serum 150 c.c.	"	9 days; improved.
120	23	Left chest one-third full of fluid.	10th "	Clear serum 1200 c.c.	None.	"	6 days.
121	32	Left chest one-third full of fluid.	13th "	Clear serum 1300 c.c.	"	"	17 "
122	34	Left chest half full of fluid.	13th "	Clear serum 1500 c.c.	"	"	36 days; improved.
123	28	Left chest one-third full of fluid.	17th "	Bloody ser. 100 c.c.	Clear serum 100 c.c.	"	22 days; improved.
124	25	Left chest two-thirds full of fluid.	17th "	Clear serum 1150 c.c.	Clear serum 1100 c.c.	"	35 days.
125	26	Right chest one-third full of fluid.	33d "	Bloody ser. 1000 c.c.	None.	"	5 "
126	29	Left chest one-third full of fluid.	34th "	Clear serum 1250 c.c.	"	"	6 "
127	7	Left chest one-third full of fluid.	17th "	Turbid ser. 300 c.c.	"	"	12 "
128	37	Left chest full of fluid.	9th "	Clear serum 1750 c.c.	Clear serum 1100 c.c.	"	9 "
129	35	Left chest one-third full of fluid.	17th "	Clear serum 1300 c.c.	Clear serum 900 c.c.	"	12 "
130	58	Right chest two-thirds full of fluid.	20th "	Clear serum 1160 c.c.	None.	"	12 "
131	35	Left chest full of fluid.	31st "	Clear serum 1200 c.c.	Clear serum 1400 c.c. 250 c.c.	"	9 days; improved.
132	11	Right chest two-thirds full of fluid.	16th "	Cloudy ser. 400 c.c.	None.	"	21 days.
133	29	Right chest two-thirds full of fluid.	31st "	Clear serum 270 c.c.	"	"	8 "
134	29	Right chest full of fluid.	16th "	Clear serum 2100 c.c.	"	"	9 "

No.	Age	Condition of the chest on admission.	Day tapped.	Character of the fluid.	Subsequent tappings.	Other treatment.	No. of days from first tapping to end of pleurisy.
135	19	Right chest half full of fluid	19th day	Bloody ser. 5 ounces.	None.	None.	4 days.
136	45	Right chest two-thirds full of fluid.	30th "	Greenish ser. 1560 c.c.	"	"	7 "
137	27	Left chest half full of fluid.	16th "	Brownish ser. 315 c.c.	"	"	7 "
138	30	Right chest half full of fluid.	23d "	Clear serum 600 c.c.	"	"	8 "
139	47	Left chest half full of fluid.	31st "	Clear serum 900 c.c.	"	"	4 "
140	34	Right chest two-thirds full of serum.	37th "	Greenish ser. 2640 c.c.	"	"	20 "
141	40	Right chest three-fourths full of fluid.	46th "	Clear serum 2160 c.c.	"	"	23 "
142	31	Left chest two-thirds full of fluid	12th "	Clear serum 7 ounces.	"	"	6 days; improved.
143	50	Left chest half full of fluid.	29th "	Bloody ser. 200 c.c.	"	"	3 days.
144	33	Right chest two-thirds full of fluid.	72d "	Clear serum 900 c.c.	"	"	7 "
145	48	Right chest two-thirds full of fluid.	17th "	Clear serum 300 c.c.	"	"	4 "
146	33	Left chest half full of fluid.	72d "	Clear serum 2000 c.c.	"	"	17 "
147	22	Left chest half full of fluid.	22d "	Clear serum 1250 c.c.	Clear serum 1100 c.c, 1000 c.c.	"	10 "
148	38	Right chest half full of fluid.	24th "	Brown ser. 400 c.c.	None.	"	6 "
149	23	Right chest three-fourths full of fluid.	29th "	Clear serum 900 c.c.	"	"	6 "
150	48	Right chest half full of fluid.	20th "	Clear serum 1560 c.c.	"	"	22 "
151	28	Left chest two-thirds full of fluid.	61st "	Clear serum 1100 c.c.	Clear serum 750 c.c.	"	10 "
152	18	Left chest half full of fluid.	4?d "	Clear serum 1000 c.c.	None.	"	4 "
153	31	Left chest half full of fluid.	11th "	Clear serum 1100 c.c.	450 c.c.	"	10 "
154	17	Right chest two-thirds full of fluid.	17th "	Clear serum 800 c.c.	None.	"	9 "
155	61	Right chest half full of fluid.	11th "	Clear serum 1600 c.c.	850 c.c.	"	13 "
156	24	Right chest two-thirds full of fluid.	15th "	Clear serum 600 c.c.	800 c.c.	"	30 "
157	46	Right chest half full of fluid.	20th "	Clear serum 1200 c c.	480 c.c.	"	20 "
158	24	Right chest half full of fluid.	8th "	Clear serum 900 c.c.	None.	"	13 "
159	42	Left chest half full of fluid.	12th "	Clear serum 1250 c.c.	1350 c.c.	"	16 "
160	49	Left chest half full of fluid.	43d "	Turbid ser. 500 c.c.	125 c.c.	"	7 "
161	27	Right chest two-thirds full of fluid.	21st "	Clear serum 700 c c.	20 c.c.	"	5 "
162	32	Left chest half full of fluid.	14th "	Clear serum 1000 c.c.	None.	"	1 "
163	38	Left chest two-thirds full of fluid.	17th "	Clear serum 1580 c.c.	64 c.c.	"	8 "
164	49	Left chest two-thirds full of fluid.	17th "	Clear serum 1920 c.c.	1856 c.c.	"	6 "
165	29	Right chest two-thirds full of fluid.	54th "	Clear serum 1920 c.c.	480 c.c.	"	6 "
166	30	Right chest half full of fluid.	12th "	Bloody ser. 840 c.c.	None.	"	5 "
167	56	Left chest two-thirds full of fluid.	23d "	Clear serum 1728 c.c.	1?8 c.c.	"	7 "
168	18	Left chest two-thirds full of fluid.	14th "	Turbid ser. 1984 c.c.	None.	"	2 "
169	60	Right chest two-thirds full of fluid.	19th "	Clear serum 1920 c.c.	"	"	8 "
170	38	Right chest half full of fluid.	23d "	Turbid ser. 460 c.c.	"	"	17 days; improved.
171	22	Right chest two-thirds full of fluid.	13th "	Turbid ser. 1400 c.c.	"	"	2 days.
172	24	Left chest half full of fluid.	51st "	Turbid ser. 550 c.c.	"	"	2 "

No.	Age	Condition of the chest on admission.	Day tapped.	Character of the fluid.	Subsequent tappings.	Other treatment.	No. of days from first tapping to end of pleurisy.
173	8	Left chest full of fluid.	15th day	Clear serum 600 c.c.	None.	None.	1 day.
174	39	Left chest half full of fluid.	23d "	Clear serum 2200 c.c.	"	"	2 days.
175	57	Left chest two-thirds full of fluid.	51st "	Clear serum 2100 c.c.	1600 c.c.	"	6 "
176	41	Left chest half full of fluid.	41st "	Clear serum 1475 c.c.	None.	"	1 "
177	16	Left chest half full of fluid.	68th "	Turbid ser. 600 c.c.	"	"	3 "
178	30	Left chest two-thirds full of fluid.	24th "	Clear serum 1100 c.c.	"	"	2 "
179	30	Right chest one-third full of fluid.	14th "	Bloody ser. 380 c.c.	"	"	2 "
180	29	Left chest half full of fluid.	6th "	Clear serum 200 c.c.	"	"	1 "
181	23	Right chest half full of fluid.	31st "	Bloody ser. 875 c.c.	"	"	1 "
182	26	Whole right chest full of fluid.	32d "	Turbid ser. 900 c.c.	1800 c.c. 576 c.c.	"	23 "
183	12	Right chest two-thirds full of fluid.	11th "	Clear serum 1000 c c.	None.	"	13 "
184	25	Left chest half full of fluid.	7th "	Clear serum 1000 c.c.	"	"	10 "
185	25	Right chest half full of fluid.	22d "	Clear serum 900 c.c.	100 c.c.	"	8 "
186	37	Left chest three-fourths full of fluid.	8th "	Clear serum 2100 c.c.	500 c.c. 100 c.c.	"	39 "
187	33	Left chest full of fluid.	56th "	Clear serum 1100 c.c.	2000 c.c. 1350 c.c. 400 c.c.	"	34 days; improved.
188	38	Right chest two-thirds full of fluid.	56th "	Clear serum 1100 c.c.	500 c.c.	"	15 days.
189	50	Left chest two-thirds full of fluid.	23d "	Clear serum 1100 c c.	Clear serum 960 c.c.	"	10 "
190	23	Right chest two-thirds full of fluid.	17th "	Clear serum 1350 c.c.	None.	"	15 "
191	57	Left chest two-thirds full of fluid.	21st "	Clear serum 1100 c.c.	3400 c.c. 1450 c.c. 525 c.c.	"	36 days; improved.
192	61	Left chest half full of fluid.	8th "	Clear serum 1600 c.c.	None.	"	7 days.
193	26	Left chest half full of fluid.	9th "	Clear serum 1900 c.c.	400 c.c.	"	8 "
194	22	Left chest two-thirds full of fluid.	7th "	Clear serum 1600 c.c.	150 c.c.	"	11 "
195	35	Right chest half full of fluid.	29th "	Clear serum 2500 c.c.	None.	"	32 "
196	71	Right chest half full of fluid.	5th "	Clear serum 1150 c.c.	"	"	14 "
197	37	Left chest half full of fluid.	23d "	Clear serum 550 c.c.	"	"	25 days; improved.
198	26	Right chest half full of fluid.	17th "	Clear serum 300 c.c.	400 c.c.	"	23 days.
199	40	Left chest two-thirds full of fluid.	24th "	Clear serum 300 c.c.	500 c.c. 550 c.c.	"	24 days; improved.
200	39	Left chest two-thirds full of fluid.	9th "	Clear serum 1150 c.c.	1650 c.c. 550 c.c.	"	28 days; improved

In the first 82 cases of the table, besides the aspiration, medical treatment was employed; in the subsequent cases aspiration was the only treatment.

It will be noted, in the first place, that none of the patients died, none of them were injured by the operation, and in none of them was the chest infected.

In all of the patients the quantity of fluid in the chest was considerable and occupied the lower part of the pleural cavity.

The fluid taken from the chest was bloody in 25 cases, turbid in 18 cases, and clear serum in the rest. The character of the fluid seemed to make no difference. Those with bloody or turbid serum did as well as those with clear serum.

In 121 of the cases the pleurisy was on the left side, in 79 on the right side.

The quantities of fluid aspirated were as follows: 6 cases, 3000 to 3500 c.c.; 23 cases, 2000 to 2500 c.c.; 37 cases, 1500 to 2000 c.c.; 55 cases, 1000 to 1500 c.c.; 49 cases, 500 to 1000 c.c.; 30 cases, 100 to 400 c.c.

Of the 200 cases 182 left the hospital entirely cured; 6 left the hospital within ten day after the aspiration, and probably recovered; 6 left the hospital at periods of from seventeen to thirty-six days after the aspiration, the pleurisy was better, but the results were uncertain; 6 left the hospital at the end of from twenty-four to thirty-eight days, not at all improved.

Of the 182 cases which were cured, the length of time which elapsed from the beginning of the pleurisy to the day of aspiration was as follows:

		7 months	. . . . .	1 case.
		90 days	. . . . .	5 cases.
70	to	75 "	. . . . .	3 "
60	"	70 "	. . . . .	9 "
50	"	60 "	. . . . .	6 "
40	"	50 "	. . . . .	9 "
30	"	40 "	. . . . .	15 "
20	"	30 "	. . . . .	39 "
10	"	20 "	. . . . .	71 "
5	"	10 "	. . . . .	20 "
		4 "	. . . . .	2 "
		3 "	. . . . .	1 case.

It will be seen that in more than one-half of the cases the duration of the pleurisy before aspiration was between ten and thirty days.

In all of the cases the pleurisy was going on as an inflammation up to the time of the aspiration; the patients had not been at all improved either by nature or by the different medicines which they had taken.

The length of time which elapsed from the aspiration to the entire cure of the patient was as follows:

Within	one week	. . . . . 64 cases.
"	two weeks	. . . . . 138 "
"	three weeks	. . . . . 158 "
"	four "	. . . . . 169 "
"	six "	. . . . . 179 "

As to the number of aspirations: The operation was done once in 142 cases, twice in 45 cases, three times in 9 cases, and four times in 4 cases.

In private practice the results are better than in the hospital. In the fortunate cases, within twenty-four hours after one aspiration there is no more fluid and no more pleurisy. In a large number of cases the pleurisy is cured within a week, and none of them ought to be sick longer than two weeks.

PANCREATIC LITHIASIS, WITH REPORT OF A CASE.*

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The scanty literature of pancreatic lithiasis, as well as general pathological records, give little exact information on the frequency with which pancreatic concretions are found in the gland after death.

Decisive evidence *intra vitam* of the existence of pancreatic lithiasis by the recovery of the characteristic concretions from the stools is exceedingly rare.

The literature contains the record of only six cases in which either a positive diagnosis of pancreatic lithiasis was made, or such a pathological process was suspected during life. The cases are so rare that a brief abstract of them is permissible.

Case I.—Capparelli's.[1] An abscess developed in the epigastric region, and through a fistulous opening which was established and persisted for six years, over 100 small prancreatic calculi were passed from time to time. The fistula finally closed, and a month later the existence of a glycosuria was discovered, which, it is stated, yielded to treatment. Capparelli believed that an interstitial pancreatitis was produced by the inflammatory affection, which in turn was the cause of the glycosuria.

Case II.—Lancereaux's.[2] Eight years before the patient, a female, came under observation, there had been several attacks of sharp abdominal colic, and the stools were stated to have been "fatty." No further disturbance of health occurred until eighteen months before admission to hospital, when symptoms of glycosuria developed, and the patient finally was admitted presenting all the symptoms of advanced diabetes mellitus.

The existence of a pancreatic lithiasis was regarded as probable from the development of a diabetes subsequent to the attacks of abdominal colic.

At autopsy, the body of the pancreas was found to be reduced to a simple fibrous cord, and occupied almost exclusively by the pancreatic

* Read before the Association of American Physicians, Washington, 1902.

duct. The head was better preserved. The canal of Wirsung opened into the duodenum 2 centimetres above the ampulla, and its orifice was occluded by a calculus of the size of a small pea.

CASE III.—Leichtenstern's.[3] Following a severe attack of what was believed to be biliary colic without jaundice, three concretions, varying in size from a millet-seed to a pea, were recovered from the stools. Chemical analysis showed that these were composed of the carbonate of lime without traces of bile pigment or cholesterin.

CASE IV.—Leichtenstern's.[3] The patient had suffered during a period of two years from periodic and exceedingly severe attacks of abdominal colic, with vomiting. On one occasion icterus had been present. A diagnosis of cholelithiasis was made by several physicians, a cholecystotomy was performed, but no biliary calculi were found. The attacks of pain continued and made life unendurable. A second laparotomy was done, and no biliary calculi being discovered the pancreas was explored. It was found to be enlarged. At autopsy, on section, the pancreas was found to be riddled with small abscesses varying in size from a millet-seed to a pea, in which, as well as in the ducts, there were numerous pancreatic concretions.

The sequence of events was evidently pancreatic lithiasis, secondary infection, suppurative pancreatitis.

CASE V.—Lichtheim's.[4] A definite and correct diagnosis was made during life in this case.

The patient, a male, thirty-six years of age, gave a history of attacks of severe pain in the epigastric region, accompanied by vomiting and fever, beginning fourteen years before admission to the hospital, and recurring at intervals during a period of six years.

Following this period he remained well until one year before admission, when he began to suffer from diarrhœa, sudden in onset, and without apparent cause. There was an absence of pain and fever. Appetite and thirst were increased. Emaciation and weakness progressively increased.

On admission to hospital, physical examination was negative, except as to the lungs, which showed evidence of tuberculosis.

The urine contained a large amount of sugar which disappeared after two weeks of strict diet, and remained absent.

The patient died three weeks later as a result of exhaustion from the diarrhœa and the tuberculous infection.

The diagnosis of pancreatic lithiasis was made by Lichtheim previous to the death of the patient.

This diagnosis was based upon the attacks of severe colic with fever and vomiting in the previous history of the patient. These symptoms were clearly those of calculi. Gallstones were excluded by the absence of signs of biliary stagnation notwithstanding the long duration of the attacks. Renal calculi were excluded by the site of the pain and the absence of urinary signs.

In consideration of the subsequent diabetes, Lichtheim believed the attacks of colic to have had their origin in the pancreas, and assumed them to have been due to calculi, and the resultant diabetes to pancreatic cirrhosis. The diarrhœa was also attributed to the pancreas, through disturbance of intestinal digestion from failure of pancreatic secretion. Intestinal tuberculosis had been excluded by the absence of bacilli in the stools.

"Typical fatty stools" were not observed, although fats were administered experimentally. The abundant muscle fibres found in the stools were considered to be of doubtful diagnostic value, through the restriction of the patient to a strict meat diet, and in the presence of a free diarrhœa.

Autopsy showed marked dilatation of the main pancreatic duct, which was filled with a grayish fluid in which were three large and many small mortar-like concretions.

The dilatation extended to the lesser ducts and as far as the cauda. The substance of the pancreas consisted chiefly of firm connective tissue, in which, however, small lobules of glandular tissue were distinctly visible.

Lichtheim believes his case to be the first in which the significance of the symptoms was appreciated during life, with the exception of Capparelli's. He quotes Friedreich, who asserts the impossibility of differentiating between biliary and pancreatic colic, inasmuch as the pancreatic calculi must exert compression simultaneously on the common bile-duct when they occlude the pancreatic duct. Lichtheim points out that his case demonstrates that this does not invariably occur, and that under some conditions the differential diagnosis can be made. In Case VII. of this series, also, occlusion of the common bile-duct did not occur.

Case VI.—Minnich's.[5] A correct diagnosis of pancreatic lithiasis *intra vitam* was made in this case also.

The patient, a male, aged sixty-eight years, gave a history of prolonged attacks of biliary colic, demonstrated to be such by the recovery of typical gallstones from the stools on two occasions, twenty-eight and eighteen years, respectively, before admission to the hospital. Two slight attacks of a similar nature, apparently, occurred six months before admission. A month before admission there was a slight attack of epigastric pain, lasting a fortnight, followed by a severe attack of diarrhœa without pain.

On admission to hospital the patient stated that he had suffered from a severe pain located in the left epigastric region since the previous day. The sclera presented a slightly yellowish tinge, but the skin was not discolored. Careful abdominal palpation gave entirely negative results.

The patient described his pains as follows:

"There is at first a dull, oppressive, constricting sensation in the epigastrium and under the left costal arch within the nipple line, which at times impels him to take deep inspirations, and at times causes him to press upon the painful region with his hand. The pains soon increase until they become true paroxysms, and become more and more localized at a point close under the left costal arch and inside of the nipple line. At the height of the attack, the pain radiates from this point along the costal arch to the spine, and spreads with severity up under the left shoulder-blade.

"As the pain subsides it retreats to the point described, under the left costal arch, the area of which can be covered by a five-franc piece."

A careful examination of this area, as well as of the other painful regions, elicited nothing positive except a slight sensitiveness on deep palpation.

The attack ceased suddenly after two hours, and the patient felt perfectly well and was decidedly hungry.

An examination of the urine passed immediately after the attack showed it to be free from albumin, sugar, and biliary pigment.

Subsequent attacks occurred almost daily, and were variable in severity.

The stools were carefully searched during twelve consecutive days, with the result of finding concretions varying in size from that of a cherry-pit to irregular detritus. The concretions were tough, semi-solid in consistence. They were fractured by the pressure of the finger, but not reduced to powder. They were too coherent to be amalgamated by pressure. Nearly smooth superficially, gray externally, and of a dull white lustre on section, resembling fruit-seed. No stratification or nucleus discerned. Microscopically, amorphous. Chemically, easily soluble in chloroform, giving a turbid fluid. On heating in a tube, a thick smoke of strong aromatic odor was given off, yellowish tinged water condensed in the cooler portion, and a residue of carbonate and phosphate of lime was obtained.

The attacks gradually abated in severity and frequency. After a time concretions were no longer detected.

The patient recovered his usual health at the end of a month.

No sugar or albumin was detected at any time in the urine. There was no loss of weight, and there was no fever at any period.

I am able to present to the Association the clinical report of an additional case, in which characteristic pancreatic calculi were recovered from the stools.

Case VII.—Mrs. H., aged forty-two years. Family history unimportant. Personal history: In 1888 the patient suffered from a slight attack of the following nature:

A sudden onset of pain, first felt in the back between the shoulders, thence gradually extending from the point of origin around the right side along the lower intercostal spaces, accompanied by nausea and vomiting, uncontrollable for a number of hours. Gradual subsidence of all the symptoms without medication; a slight diarrhœa accompanied and followed the attack; duration of the attack eight or nine hours. Similar though severer attacks in August and May, 1897 and 1898, respectively—three altogether. None of the attacks described were accompanied by jaundice, and biliary calculi were not found in the stools. They were believed to be due to a cholelithiasis. No further attack until January, 1901, when one of an exceedingly severe character occurred. The pain was first felt between the shoulder-blades, thence extended through and not around the body into the epigastrium, and became localized rather to the right of the median line. Vomiting occurred only once; the pain was very acute, necessitating the use of large hypodermic injections of morphine, which afforded only partial relief. The bowels were constipated throughout the attack, which was of three days' duration. More or less abdominal pain and much general abdominal sensitiveness were experienced for four weeks subse-

quent to the acute attack. Jaundice was not present at any period. On the sixth day from the beginning of the attack, six small stones, the size of a pea, were passed by the bowel. The patient had been under the care of a New York physician, and was seen in consultation by Dr. Janeway. It was believed that she was suffering from biliary colic. Dr. Janeway's attention was attracted by the appearance of the concretions passed, and he secured them for chemical analysis. Four of the concretions were analyzed and were found to consist of the carbonate and phosphate of lime without traces of cholesterin or bile pigment, indicating their origin in the pancreatic ducts. A similar though less severe attack occurred three weeks later, and others in August, October, and November, 1901—five in all. The attack in August occurred in Berlin under the observation of Professor Leyden's assistant, Dr. Wohlgemuth. A small fragment of a calculus and considerable detritus were recovered from the stools, and the patient states that their origin in the pancreas was asserted. The attack in November occurred in San Francisco under the observation of Dr. McMonagle. Although no concretions were recovered from the feces, considerable detritus was obtained, which was found to be composed of the carbonate and phosphate of lime.

The patient first came under my observation on December 25, 1901, on her arrival from San Francisco, whence she had come for further medical treatment.

One of the concretions passed by the bowel in the attack of January, 1901, was given to me for examination. A chemical analysis showed it to be identical in its composition with those analyzed by Dr. Janeway. The only concretion unanalyzed and which is identical in its appearance with the others, I am able to show you. It weighs 7 centigrammes, with diameters 5.8 millimetres by 5.9 millimetres by 6.2 millimetres. It will be seen that its surface is slightly rough, with several deep grooves. The material of which the surface is composed is found by chemical analysis to be phosphate of lime without admixture of the carbonate. The whole stone is very friable. The patient stated that she had suffered almost continuously from intestinal indigestion and from epigastric discomfort since the last attack in November, and for the previous ten days there had been more or less continuous epigastric pain. She had also lost much in weight. Careful physical examination only elicited the signs of a moderate degree of displacement of the right kidney and distinct sensitiveness over the region of the gall-bladder. Its palpability was considered doubtful. On the following day an acute attack occurred.

As in all previous attacks, the pain began in the middle of the back between the shoulder-blades and extended through and not around the body, locating itself in the central epigastric region. There was accompanying nausea and vomiting. There were recurring paroxysms for forty-eight hours, when they ceased. The urine even at the beginning of the attack contained traces of bile pigment, but no glucose. Later a slight degree of jaundice was appreciable, which speedily disappeared. Similar attacks occurred on January 13th and 18th, except that they were preceded by a sharp chill, followed by a rise of temperature to 104° F., which was again normal at the end of eight hours. No jaundice accompanied these attacks. All the stools from the beginning were passed through a very fine sieve, but no concretions were recovered.

Following the last attack, a few white particles were recovered, which on chemical analysis were found to consist of calcium soaps (calcium oxide, 7.9 per cent.; higher fatty acids, including moisture and foreign matter adherent, 92 per cent.).

Finally, two very severe attacks accompanied by jaundice occurred during the subsequent three weeks, and a calculus was recovered from the stools on each occasion. Their composition was found to be nearly identical. Chemical analysis of the central portion of one concretion gave 92.44 per cent. cholesterin, and other organic and mineral matters, including moisture, 7.56 per cent., indicating its biliary origin. It is of interest to note that cultures of the central portion gave no growth.

There has been an absence of attacks since those last described, but there has been continuous epigastric discomfort and pain located in the central portion of the back.

Throughout the period that the patient has been under observation very frequent examinations of the urine have never revealed any trace of sugar.

Immediately subsequent to the attack of January 18th, the color of the feces indicating a free flow of bile into the bowel, an investigation was undertaken to determine the utilization of the fat of a known diet. The report of the details of the investigation is appended: 101 4 grammes of fat were ingested during a period of forty-eight hours, and 11.1 grammes were recovered from the feces, indicating a normal absorption.

On the other hand, the composition of the fat was: neutral fat, 42.6 per cent.; fatty acids, free, 19.2 per cent.; fatty acids, soaps, 38.2 per cent. According to Müller,[6] 42.6 per cent. of neutral fat in the feces is much above the normal and indicates an at least *diminished* flow of pancreatic secretion into the intestine.

The clinical history of the case presents many points of interest. The decisive evidence *intra vitam* of the existence of a pancreatic lithiasis and its alternation with a cholelithiasis, are of special interest. In view of the origin of biliary calculi in many instances in an infection of the gall-bladder, an origin of pancreatic calculi in an infection of the ducts would not seem improbable. The clinical history of the patient in the past and her present symptoms suggest an explanation of the deficient utilization of the ingested fat. A pancreatic lithiasis *preceded* the cholelithiasis. It would seem probable that it also *coexisted* with the cholelithiasis, and that it is still present with partial occlusion of the pancreatic duct or ducts.

A study of the cases related indicates the difficulties of differential diagnosis between pancreatic lithiasis and cholelithiasis, in the absence of concretions in the stools. As Oser[7] remarks, almost as great difficulties obtain in the diagnosis of pancreatic disease in general, due to the fact that only extensive destructive processes in the organ or the closure of both ducts, produce characteristic symptoms. Coincident disease of neighboring organs, either a cause or a result of pancreatic disease, may produce symptoms more distinct and impressive

than those of the latter. A biliary calculus may lead to a chronic pancreatitis through its obstruction in part or wholly to the outflow of the pancreatic secretion into the intestine, and in itself produce symptoms which mask those of the pancreatitis.

It will be of interest to consider the symptoms which have been described by various authorities as those of occlusion of the pancreatic ducts.

1. None of the subjective symptoms, such as nausea, vomiting, diarrhœa, can be regarded as characteristic. The belief that a ptyalism of varying degree accompanies a deficient secretion of the pancreatic juice, either through occlusion of the ducts or disease of the gland, is not borne out by clinical experience.

2. Clinical evidence indicates that the pain present in pancreatic lithiasis probably differs neither in kind nor location from that of cholelithiasis. In the single case of Minnich, the location of the pain along the left costal arch was possibly suggestive. On the other hand, in my own case, the patient was very positive that the pain in the attacks preceding the passage of the pancreatic concretions, and in the attack in which the concretions were recovered, began either along the right costal arch or in the back, finally becoming localized to the right of the median line.

3. The presence of an unusual number of undigested striated muscle fibres in the stools cannot be regarded as a basis for positive diagnostic conclusions. Abnormal quantities of muscle fibres are often passed in other disturbances of the intestinal digestion. In any free diarrhœa this may occur.

4. *Fatty Stools.* An abnormal amount of fat in the feces is by no means a constant or even frequent symptom of pancreatic disease. In 330 cases collected by Ancelet,[8] it was found only twenty-eight times. When present, it is often due to the existence of jaundice in which the absorption of fat is enormously diminished (as much as three-quarters of the fat ingested may be returned in the stools, one-tenth being the maximum normal amount—Müller[8]), or to various affections of the absorbents of the intestines. In Case VII. the *absorption* of fat was found to be normal. A deficient *splitting up* of the ingested fat into fatty acids and soaps, on the other hand, apparently is a symptom of great value in the diagnosis of occlusion of the pancreatic ducts from any cause. Müller's[8] investigations, corroborated by Weintraud[9] and Katz,[10] show that normally 75.8 per cent. of the fat contained in the feces is split up and appears, not in the form of neutral fat, but of fatty acids or soaps, and that this also occurs in jaundice and in other pathological conditions, with the exception of cases in which the pancreatic secretion is diminished or is prevented from reaching the intestine. In such cases the decomposition into fatty acids and soaps is greatly

diminished; the average in three cases was found by Müller[6] to be only 39.19 per cent., instead of 75.8 per cent.*

A deficient splitting up of the ingested fat into fatty acids and soaps, therefore, would seem to be the only fact, so far as the feces are concerned, which points with certainty to the absence of the pancreatic secretion in the intestinal digestion. In Case VII. the fatty acids and soaps in the feces were considerably below the normal amount.

5. The presence or absence of jaundice in itself cannot be considered of diagnostic import. It is absent in a large number of cases of cholelithiasis; it may be present in pancreatic lithiasis. Jaundice in pancreatic lithiasis permits of a simple explanation. The large pancreatic duct and the common bile-duct are separated near their junction only by a thin membranous septum, and a calculus impacted in the terminal portion of the former might readily suffice to occlude the ductus choledochus by pressure. Again, a concretion small enough to pass through either the pancreatic duct or bile-duct may be too large to pass their common duodenal opening.

6. *Glycosuria.* It is well known that a glycosuria associated with obstruction of the pancreatic ducts by calculi or otherwise is the result of the superinduced interstitial pancreatitis, and the recent investigations of Opie[13] indicate that in the interlobular form, which is the prevalent form in such occlusions, glycosuria apparently only occurs when the sclerotic process has reached a very advanced grade. The absence of glycosuria, therefore, can only be regarded as a negative sign in the diagnosis of pancreatic lithiasis. Its presence is certainly suggestive.

The decisive evidence of the existence of pancreatic lithiasis in the recovery of the characteristic concretions from the stools, it has been shown, is exceedingly rare. This may be due partly to the composition of the calculi; they are small, very easily disintegrated, and may pass by the bowels in fragments or particles not readily recognized. In a number of reported cases, minute gritty particles have been found in the smaller ducts, with or without the presence of larger concretions in the main ducts.

If the symptoms described, with the single exception of the presence of pancreatic concretions in the stools, separately fail to furnish evidence of pancreatic lithiasis, their various combinations may be diagnostically suggestive.

Attacks of epigastric colic of an obscure nature, with or without jaundice, associated with large numbers of muscle fibres in the stools, accompanied or followed by a glycosuria, should be regarded as a reasonable basis for a diagnosis of pancreatic lithiasis.

* Deuscher[11] and Albu[12] in three observations of pancreatic disease claim to have found no departure from the normal.

Müller's investigations indicate that a greatly diminished splitting up of the ingested fat *per se* positively indicates the absence of pancreatic juice in the intestinal digestion. In this case, therefore, in the absence of a cachexia or other signs of a neoplasm of the pancreas or of neighboring organs which would occlude the ducts by pressure, a pancreatic lithiasis should be suspected.

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WOLFF'S LAW AND THE FUNCTIONAL PATHOGENESIS OF DEFORMITY.*

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THE correspondence between the structure of bone, under normal and abnormal conditions, and the calculations of graphic statics has been made the foundation upon which a doctrine of "functional pathogenesis" has been built. It has, however, formed also the basis of numerous attacks upon this theory. The theory of the functional pathogenesis of deformity and that of the functional shape of the bones have been made corollaries to the "law of bone transformation"[1] by its author, Jul. Wolff. The "law of bone transformation" is considered by its author as deriving its greatest strength from the remarkable resemblance existing between the internal structure of the normal human femur and the graphostatic diagram of a Fairbairn crane drawn by the mathematician Cullmann. This was given an outline similar to that of the human femur deprived of its trochanter major and viewed in coronal section, sustaining a load of 30 kilogrammes. This load is supposed to approximate that which is borne by the femur of an adult and to be applied to the crane in a manner consistent with the conditions in the human subject. The striking analogy

* Read before the American Orthopedic Association, June, 1902.

between the courses of the bone trabeculæ in the frontal section of the femur and those of the trajectories of Cullmann's diagram was first insisted upon by von Meyer. The arrangement of the spongiosa in the sagittal section of the femur, corresponding to the "neutral plane" of the diagram, was foretold by Wolff in conformity with the demands of the graphostatic figure, and was substantiated by him later, anatomically. After the most painstaking study of the various bones of the body under normal and abnormal conditions Wolff was able to formulate his "law," which might be translated as follows:

"Every change in the form and function of the bones, or of their function alone, is followed by certain definite changes in their internal architecture, and equally definite secondary alterations of their external conformation, in accordance with mathematical laws."

Before the promulgation of Wolff's law the generally accepted theory of the development of acquired deformity was that of Volkmann[3]-Hueter,[3] namely, that consequent upon muscular weakness faulty attitude was assumed, in consequence of which one side of a joint—*e. g.*, the external in genu valgum—was subjected to greater pressure than normal; the opposite side—the internal in genu valgum—sustained less pressure than normal. Assuming that during growth the normal development of the joint depends upon the maintenance of normal conditions of intra-articular pressure, it was explained that the increased pressure on the concave side interfered with the normal growth of bone or even caused atrophy of that bone already formed; while on the convex (internal) side the subnormal pressure permitted an overgrowth of bone. In spite of the fact that Mikulicz[4] and Macewen[5] showed, quite long ago, that these changes in the articular surfaces and epiphyses are not constantly present in genu valgum, but that the principal deformity exists in the diaphyses of the femur and tibia, most authors continued, nevertheless, to describe the pathogenesis of this deformity in conformity with the theory of Volkmann-Hueter. We shall later see how it is better explained by reference to Wolff's law and in agreement with the anatomical conditions present.

The first corollary which Wolff's theory has associated with it is that of the "functional shape."[6] The external form and internal architecture are determined by function solely. The internal architecture and external contour always correspond exactly, the latter representing, mathematically, simply the last curve uniting the ends of the various trajectories which make up the internal structure. The compact substance is to be regarded simply as a condensation of spongiosa.

From the theory of the "functional shape" it is an easy step to that of the "functional pathogenesis" of deformity. If the internal structure and external contour correspond exactly, and if they represent an adaptation to normal function only, then an alteration in static

demands made upon the bones must be followed by the proper transformations of structure, both internal and external, and as the result of these we have the "deformity in the narrower sense." The deformity is therefore to be regarded as a physiological adaptation of structure to pathological static requirements, therefore to pathological function.

The agreement of the structure of bone, both under normal and abnormal circumstances, with mathematical laws, and in particular with those of graphic statics, is insisted upon by Wolff to such an extent that it has formed the basis of attacks upon the doctrine by Bähr[7] and Ghillini,[8] as well as others. It is their object to show that Wolff's mathematical conclusions are erroneous, and that therefore it is not permissible to make deductions from them regarding the structure of the bones in their normal or pathological relations.

We may well ask ourselves, on this account, whether mathematical proof of the competency of nature's design in bone structure has been brought by Wolff in Cullmann's drawing of the Fairbairn crane and the deductions following. What is required to enable us to construct the graphostatic diagram of the femur? It must be understood, as a preliminary in answering this question, that when "mathematical proof" is spoken of mathematical accuracy is implied. It is by no means enough to say that a striking similarity exists between the diagram and the bone whose mechanics we are trying to solve. There must be absolutely no divergence between the two.

In order that the mechanics of the femur shall be submitted to mathematical proof, we must know every possible stress to which the bone is to be submitted under normal conditions, and these stresses must be expressed in figures. There must be possible of expression in figures the physical characteristics of the material used in the structure. But bones are evidently constructed of sufficient strength to withstand unusual stress without giving way. This fact is demonstrated in every-day life. How shall we calculate this "factor of safety." We may believe, with Wolff, that the femur is burdened like a crane, or with his opponents that this is not so; but the fact remains that Cullmann's diagram is computed without mention of the muscular stresses upon the bone—without reckoning with the stresses put upon the bones in other positions than the upright. The great trochanter has been omitted from consideration altogether. This is obviously not permissible in a mathematical calculation, because it is always present, because it is the means of transmitting very considerable stress to the femur, and because its internal structure is evidently continuous with that of the upper end of the femur. I am assured by experts that the proper calculation of the construction of the femur upon exact mathematical lines is a work of great magnitude, requiring not only uncommon ability, but, on account of the enormous complexity of the problem,

demanding a very large expenditure of time. To my knowledge, no such exact mathematical demonstration has yet been made. In addition to this, it is by no means certain that the "factor of safety" could be calculated; this factor might well make the mathematical solution impossible. Until exact mathematical proof is brought, however, there would seem to be no warrant for saying thus definitely that the external contour of a bone represents mathematically the last curve uniting the ends of the various trajectories which make up the internal structure—for assuming that the compact substance is to be regarded simply as a consolidation of those trajectories coming from the spongiosa.

If we are unprepared, however, to acknowledge that a truly mathematical demonstration of the structure of the bones has been made, we are, on the other hand, entirely unwilling to reject the law of transformation and its corollaries on this account without further investigation. In declining to accept the analogy between Cullmann's diagram and the structure of the femur as a truly mathematical demonstration of the latter, we are, furthermore, far from saying that if such computation and graphostatic figure were made it would not coincide with the architecture of the bone. On the contrary, the structure of the femur having been shown by many years of observation to be constant, the similarity between it and the mathematical figure is so striking as to make it seem reasonably certain that the trabeculæ do represent lines of force which nature aims to resist by the laying down of the bone tissue. This is, however, far from being mathematical proof, and, as it seems to us, does not afford justification for considering some of Wolff's other conclusions as "mathematical," however true they may be otherwise shown to be.

In view of the necessarily great variation in the factors of weight-bearing and muscular stresses which must exist in mammals other than man—because of the deviation from the erect position of the trunk and because of the participation of the thoracic extremities in the weight-bearing function, it would seem likely that much information could be obtained from the study of their bones. Able and exhaustive investigation has already been made in this direction by Zschokke,[10] Schmidt,[11] and others. It has seemed worth while to independently repeat some of this work as well as to seek further for information in the structure of other mammalian bones. The femur has been chosen as the bone for further comparison, because of its size and static importance and because it has formed the basis for most of the conclusions which have already been drawn. In examining the femora to be presently described the method reported by Wolff[9] was employed. Sections were cut by hand by means of a saw. These sections were then photographed by means of the Röntgen ray, and from the nega-

tives thus obtained the photographs were made which are herewith presented. As is the case with many radiographs, the negative is more instructive than the print made from it. In the smaller femora it was quite difficult to obtain prints the finer details of which would lend themselves to satisfactory reproduction.

In the description of the specimens which have been examined care has been taken to avoid as much as possible the repetition of details which coincide with the descriptions of Zschokke and Schmidt, above referred to. The following femora have been examined:

I. Ruminantia.
  (*a*) Ox.
  (*b*) Llama.
  (*c*) Sheep.

II. Carnivora.
  (*a*) South African leopard.

III. Primates.
  (*a*) Baboon (papio hamadryas).
  (*b*) Orang (simia satyrus).
  (*c*) Gibbon (hylobates).
    (Humerus of gibbon also.)

For the privilege of examining into the architecture of the femora of the orang and gibbon, as well as the humerus of the latter, I wish to acknowledge my indebtedness to the administration of the Smithsonian Institution. Many of the other bones examined have been taken from the museum of the Cincinnati Society of Natural History.

Remarks on the Specimens Examined.

I. Ruminantia. (*a*) *Femur of the Steer.* (Fig. 1.)

Relative length of the neck is short. Capital epiphysis extends laterally to a point corresponding practically with the axis of the shaft. It is covered with cartilage to this point, and is to this extent a bearing surface. The angle made by the neck is about 112°.

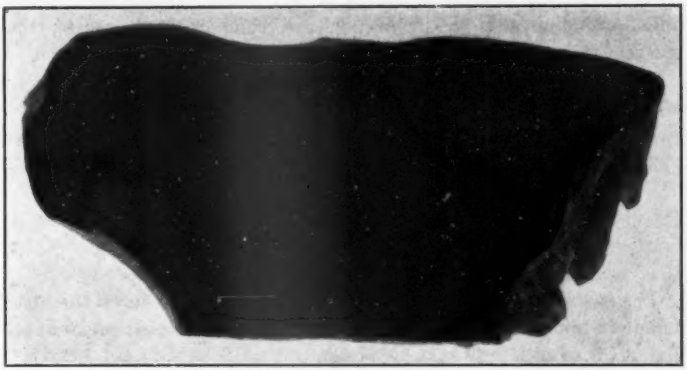
Arrangement of trabeculæ is perfectly constant, and corresponds with the description of Zschokke and Schmidt. The spongiosa of the young adult is composed of exceedingly fine trabeculæ. As the age increases the trabeculæ become coarser and less numerous, so that the internal structure is more easily read. In old animals this change has continued, so that the difference between their spongiosa and that of the young animal is most striking (see Zschokke). The three most striking systems of trabeculæ seen are:

1. *Principal pressure* trajectories (converging from the mesial part of the head to the adductor compacta).

2. Trabeculæ from adductor and abductor compacta arch toward the axis of the bones, forming a series of gothic arches whose apices

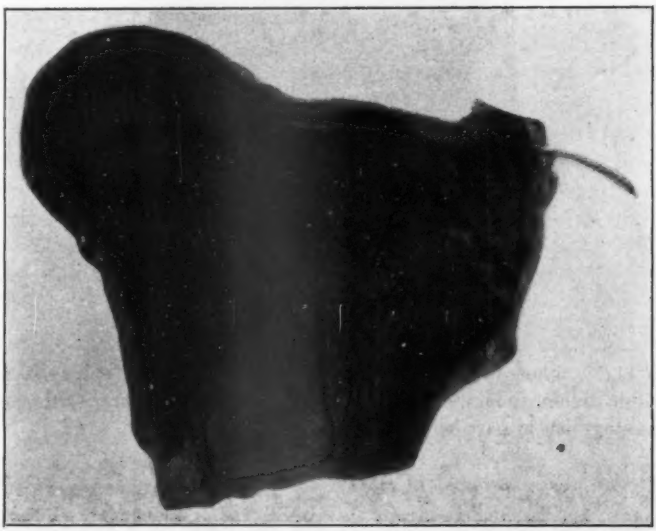
are in a straight line with the lateral boundary of the capital epiphysis. Such a series of arches also exists in the trochanteric epiphysis. Orthogonal crossings can be distinguished in the system of arches.

FIG. 1.



Femur of young adult steer.

FIG. 2.



Femur of llama.

(*b*) *Femur of the Llama.* (Fig. 2.)

There is practically no neck to the bone. Capital epiphysis extends to the axis of the shaft, as in the steer, but the head is set more obliquely, making an angle of 120° with the shaft.

Although the animal is comparatively young (shown by imperfect union of epiphysis), the trabeculæ are comparatively coarse, their meshes large. The arrangement of gothic arches is lacking.

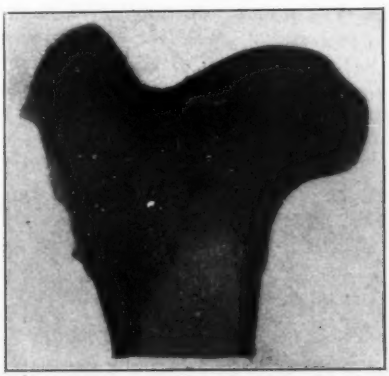
The marrow cavity extends comparatively high into the upper end of the bone. There are three systems of trabeculæ:

1. Principal pressure trabeculæ.
2. Two systems diverging from the base of the great trochanter.
   (*a*) Toward the head.
   (*b*) Downward to the abductor compacta.

(*c*) *Femur of the Sheep.* (Fig. 3.)

In general shape and plan of internal structure we have the steer's femur in miniature. The angle of the neck is somewhat greater (115°

FIG. 3.



Sheep.

to 117°), otherwise the same arrangement of capital epiphysis and gothic arches, though sometimes not so easily made out. Orthogonal crossings can in part be distinguished.

II. CARNIVORA. (Fig. 4.)

The only specimen examined was the femur of a South African leopard. The femur is characterized by its proportionately long,

slender, and somewhat curved neck, which makes an angle of 130° with the shaft. The spongiosa is made of plates.

The femoral neck presents a triangular cavity of considerable size,

FIG. 4.

Leopard.

and which in position and boundaries would correspond with Ward's triangle of the human femur. This is separated from the marrow cavity below by a small number of arches coming from the adductor

FIG. 5.

Baboon.

compacta and corresponding to pressure trajectories. The crossings here are orthogonal.

Shorn of the trochanter major the outline is very like that of Cullmann's diagram; the internal arrangement is, however, very different.

III. PRIMATES. (*a*) *Femur of Arabian Baboon* (*Papio Hamadryas*). (Fig. 5.)

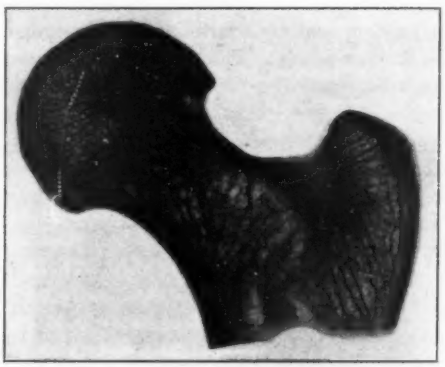
The bone is remarkably heavy for its size, and of very dense texture, so that it is difficult to saw. The neck is curved, and makes an angle of about 124°.

The trabeculæ are massive, largely in the form of plates. In the head they are fairly typical as principal pressure trabeculæ, and here show orthogonal crossings, with a few tension plates. There is here, too, a cavity in the neck, separated by a few plates only from the cavity of the shaft below. The compacta of the shaft is relatively very heavy and thick, so that it is difficult to bring it into comparison with the amount of spongiosa.

(*b*) *Orang.* (Fig. 6.)

Both in external conformation and internal structure the upper femoral end is strikingly like the human. The angle made by the

FIG. 6.



Orang.

femoral neck is 135°. Both pressure and tension trajectories are found projected in a fairly typical manner, though the reticulum is much coarser than in man, the trabeculæ more plate-like. Orthogonal crossings can be made out to a limited extent. The condensation of spongiosa known as the "intermediary epiphyseal disk" (Recklinghausen), and which is constant in the adult femur, is lacking.

(*c*) *Gibbon.* (Fig. 7.)

In general outline the upper femoral end greatly resembles that of the orang and man. The bone is remarkably light, however, its shaft

very smooth and round, reminding one very forcibly of the bones of larger birds. This comparison seems all the more apt upon bisecting the bone, because of the relatively large marrow cavity, with no spongy structure whatever save at the extreme ends. The angle of the neck is 140°.

The section shows a spongiosa of lamellar character, in which it is extremely difficult, if at all possible, to find an arrangement in any way similar to that of man or, indeed, of any of the femora previously described. The neck proper is practically free from spongy structure, a cavity being here found which extends to the spongiosa of the head above and to that at the base of the great trochanter below. The cellular spaces of the spongiosa are relatively very large.

In view of the contrast in functional importance between the femur and the humerus in the gibbon, great interest must attend the com-

FIG. 7.

Femur of gibbon.

FIG. 8.

Humerus of gibbon.

parison of their internal structures. The result of it is in accord with our anticipation. The internal structure consists of a lamellar spongiosa of comparatively coarse mesh, but in its general arrangement strikingly that of the human humerus. This is true even to the existence of a place near the great tuberosity in which the spongiosa is quite rare, almost to the degree of being considered a cavity. The remains of the epiphyseal line correspond both in direction and position, and the outline is simply a miniature of the human. (Fig. 8.)

In addition, it is to be noted that the gibbon's humerus is, in comparison with its femur, heavier and denser. On holding the bones close to a bright light the shaft of the femur is seen to be quite translucent; that of the humerus is not at all so. While the humerus is a longer bone, its density is disproportionately greater than that of the femur. The volume of the two bones was determined by ascertaining their displacement of water. This was found to be 25 c.c. for the humerus

and 22 c.c. for the femur. The weight of the humerus was 30.45 grammes against 21.67 grammes for the femur. Their ratio of weight is therefore 1.405, while their ratio of volume is 1.045. It is easily seen that the humerus is an organ of greater strength and usefulness than the femur.

In making a general comparison of the specimens in hand, it is well to remember that in graphic statics:

1. The courses of the various trajectories are dependent upon the external shape of the structures, and conversely,

2. The number of the trajectories and their size depend upon the varying factors of weight and the character of the material.

It was remarked by Zschokke—and the statement is to day equally true—that it was not possible to estimate the stresses in bone more than approximately up to that time, but that it was necessary as a matter of scientific reasoning to show, at least in some bones, that the trabeculæ truly correspond to the trajectories in direction and strength. Ten years have elapsed since this was written, but the task has not yet been performed.

Bähr, Ghillini, and the latter in co-operation with Canevazzi, have offered certain calculations in opposition, but these by no means present the solution which we seek. It would appear, therefore, that we are not yet provided with exact data to attempt a truly mathematical solution of the mechanics of the femur. If we cling too closely to the mathematical concept of bone structure we shall find it impossible, for example, to reconcile the structures in the upper femoral ends of the gibbon and the orang. We have here a striking similarity of outline, with an equally marked incongruity of internal formation.

If, however, we depart from the strictly mathematical notion and examine into the environment and habits of the gibbon and orang we shall find an admirable adaptation of structure to these and an explanation of the great variation in internal structure. According to Flower and Lydekker,* the gibbon is by nature an arboreal creature of great lightness, accustomed to maintain itself almost entirely by the thoracic extremities. Its movements are extremely rapid, and it is able to project its body through long distances in space in swinging from bough to bough and from tree to tree. When pursued on the ground and unable to reach a tree it moves forward chiefly on its pelvic extremities, and practically in the upright position, but so awkwardly and uncertainly that it is easily overtaken by man. The humerus of the gibbon, however, belongs to the extremity of greater power and use, and is manifestly of corresponding build. In the orang, on the other hand, we find great muscular power in the posterior extremities

* Mammals, Living and Extinct.

and comparative slowness in movement. We may similarly compare the femora of the leopard and the baboon, although possibly not so aptly, the former possessing wonderful agility and ability to make enormous leaps, the latter being contrasted by the great muscular development in proportion to its size. According to Zschokke, the femora of bears able and accustomed to maintain themselves frequently in the upright position possess great resemblance to the human in their structure. So in the ruminants, also, we find the modifications of internal structure in accordance with the shortness of the femoral neck, adapted, as this is, to weight-bearing purely rather than a large range of motion.

From the above we should be justified in concluding that while external conformation and internal structure represent admirable adaptation to use, their mutual interdependence is not so exact as the strictly mathematical concept would require. If we are to modify the doctrine of the functional shape of the bones to this extent, it is probable that the doctrine of functional pathogenesis must likewise be qualified.

Valuable evidence for the theory of functional pathogenesis should be found where the function of a bone has been changed for a considerable time without any gross solution of its continuity. It is believed that such evidence can be found in the specimen of old unreduced dislocation of the hip which is next presented, and in which we have the advantage of comparison with the normal femur of the same individual.

Description of Specimen of Old Unreduced Dislocation of the Hip, from the Museum of the Cincinnati Hospital (Series VII., No. 127 f).

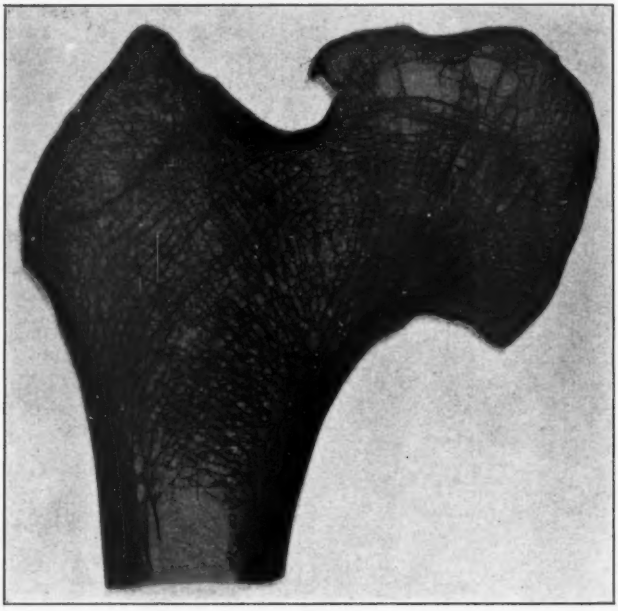
The specimen has been in the Museum for many years, and all clue to the history of the case has been lost. The board has wired upon it:

The Os Innominatum of the Side of the Luxation. This shows the acetabulum to have been unoccupied by the femoral head for a long time. The floor has become roughened by the presence of small osteophytes. The acetabular cavity appears to have become smaller by the thickening of its rim and the formation of new bone in its floor. Just behind the acetabulum there is seen a rather flat, though slightly concave, bone mass of roundish outline, with a diameter of 5 to 3.5 cm., and elevated 0.52 to 0.53 cm. above the surface of the surrounding bone. This rests upon a buttress of bone thrown out from the ilium and ischium. It is evidently the representation of an attempt at forming a new acetabulum.

The Upper End of the Right (Dislocated) Femur. (Fig. 9.) This has been sawed through about 8 cm. below the tip of the great trochanter. It has also been bisected in coronal section.

The Upper End of the Left Femur (Normal). (Fig. 10.) This has been sawed through at 6.7 cm. below the tip of the great trochanter, the cut just striking the tip of the lesser trochanter. It has also been bisected in coronal section. Upon joining the halves of the right (luxated) femur and attempting to fit the head, in its dislocated position, into the new acetabulum, it is readily seen that its superior surface—that which formerly was the chief means of transmitting weight—was no longer a bearing surface, but that the joint bearing under the new conditions

FIG. 9.



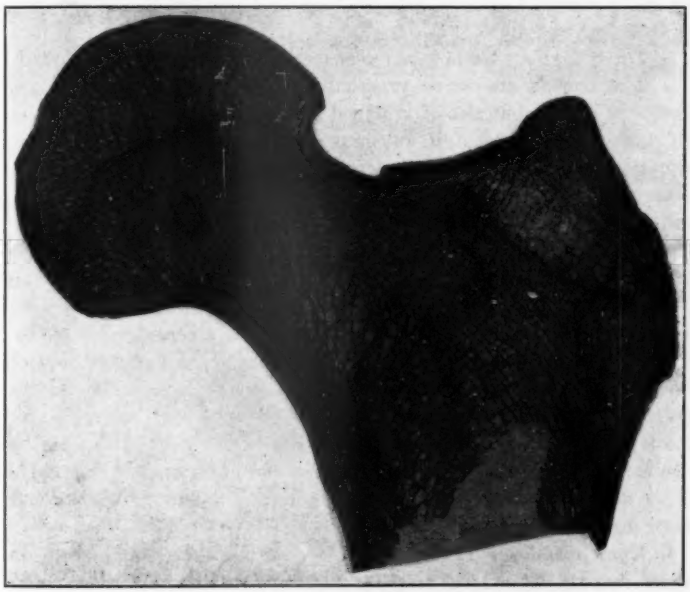
Dislocated femur.

was displaced downward. It can be seen that the position of the femur could not have been maintained by the bony socket alone, but that the soft parts must have played an important if not the chief rôle in this.

The examination of the femoral head shows at once that it may be divided, functionally, into an anterior and posterior, an upper and lower segment. The anterior segment is characterized by the smoothness of its external contour and its roundness when compared with the posterior segment, which is rough, presenting irregular elevations. The

margin of the head in the posterior segment is considerably mushroomed; this is not so in the anterior. The corticalis of the posterior segment is very thin, and in one place has disappeared, so that the spongiosa is exposed. (This is not broken.) The head is no longer nearly spherical, but bullet-shaped, with a rounded apex in the line of the cervical axis. Crossing the anterior segment is a slight ridge which divides the anterior segment into an upper and lower portion. The upper portion is somewhat rougher and flatter than the lower, and this division will be later referred to in the description of the section.

FIG. 10.



Normal femur from same subject.

From the anterior half of this femur a section was cut varying from 3 to 4 mm. in thickness. A similar section was taken from the left femur. Through a mishap the spongy portion in the lower portion of this section was broken. The spongy tissue should be intact through the section. The following measurements show in part the decided differences existing between the right and left femurs: Diameter from the circumference of the head to the base of trochanter major: right, 8.75 cm.; left, 10.40 cm. Height of trochanter major from tip to base: right, 4 cm.; left, 4.46 cm. Greatest thickness of adductor compacta: right,

0.58 cm.; left, 0.44 cm. Greatest thickness of abductor compacta: right, 0.57 cm.; left, 0.34 cm. Angle between the neck and shaft: right, 122°; left, 127°.

The following changes of external configuration may therefore be noted: (*a*) General diminution in the size of the bone; (*b*) diminution of the angle between the shaft and the neck; (*c*) alterations in the shape of the femoral head, as before described.

The transmutations of the internal structure are, however, more striking, and when taken in conjunction with the above-mentioned alterations of external contour, and in view of the changed conditions of stress from both weight-bearing and muscular action, make it possible for us to present a rational interpretation. These transmutations may be described as follows:

1. The cancellous tissue is of looser mesh than that of the left femur.

2. The tension trabeculæ proceeding from the abductor side are shorter in length, but also of changed (shortened) radii. The pressure trabeculæ, however, seem, if anything, more numerous and of greater strength than those of the left femur. As the result of this, Ward's triangle, which is ordinarily constituted by the convergence of two well-defined groups of trabeculæ coming from the upper part of the head and region of the great trochanter, respectively, has disappeared entirely.

3. The most conspicuous change of the internal composition is, however, to be observed in the head. We have here a considerable cavity in the spongy tissue, corresponding in position to the flattened part of the head, and which is traversed by a few bone plates. The antero-posterior depth of this cavity is 2.50 cm.; its width in the coronal section is 2 cm. The antero-posterior diameter of the head at this part is 3.40 cm. The floor of this cavity corresponds exactly with that ridge on the anterior aspect of the head which divides this into an upper and lower segment.

4. Upon examining the anterior and posterior halves of the bone, it is seen that the cancellous arrangement in the anterior segment is more compact.

Unfortunate as it is for the present inquiry that no record is left to show the exact amount of motion and strength possessed by this dislocated hip, the changes of its structure nevertheless correspond strikingly with the requirements of Wolff's law. The atrophy of the unused parts, and the condensation of those bearing increased stress, as well as the decided change of external conformation, are sufficiently manifest as to impossibly escape notice. Equally evident, however, are the encroachment upon the original size of the acetabular cavity by the formation of new bone, and the irregular surface of the unused part of the femoral head for the same reason. I take it that we have here conditions

analogous to the so-called hypertrophy of the inner condyle in genu valgum, and that we are dealing with an increase in cubical dimensions as an accommodation to altered conditions of space. If this increase of cubical dimensions is to be so regarded it must be looked upon as a result of the deformity and not as one of its causes. Its functional rôle in resisting stress can, from its physical characters, be considered insignificant.

From the researches of Wolff, Zschokke, Schmidt, and others, as well as from the observations herewith presented, it is believed justifiable to conclude as follows:

1. The strictly mathematical concept of Wolff's law has not yet been justified by demonstration.

2. Save in their mathematical aspects, the statements of Wolff's law and its corollaries may be accepted as being in agreement with observations hitherto made.

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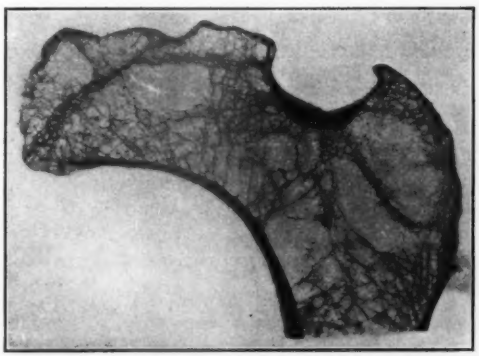

Section of femoral head of a paralytic idiot, aged thirty-five years. (By permission of Dr. R. T. Taylor.)

of age, by Dr. R. Tunstall Taylor, of Baltimore. The specimen is of such interest, and is believed to be corroborative to such a degree, that, with Dr. Taylor's kind permission, the case and section of the bone are herewith briefly presented. The subject from whom it came was

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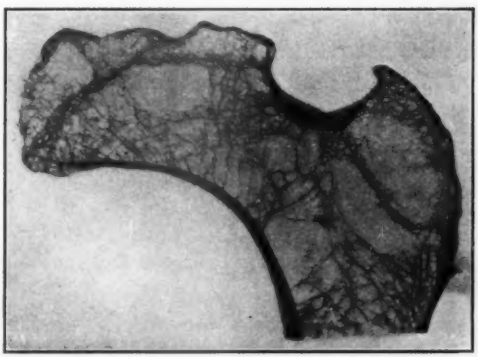

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(By permission of Dr. R. T. Taylor.)

of age, by Dr. R. Tunstall Taylor, of Baltimore. The specimen is of such interest, and is believed to be corroborative to such a degree, that, with Dr. Taylor's kind permission, the case and section of the bone are herewith briefly presented. The subject from whom it came was

a paralytic, considerably deformed, having severe scoliosis and being greatly underdeveloped. The fibula of this subject was about fifteen inches long and somewhat greater in thickness than a good-sized knitting-needle. The pelvis was likewise deformed. The femur is extremely light in weight. Its extreme length is 38 cm.; the coronal diameter of the shaft at the middle is 1.3 cm. The head is greatly flattened from above downward, as may be seen from the section. The surface is marked by several deep grooves of antero-posterior direction. Otherwise the bone is of fairly normal shape, with the exception of the trochanter minor, which forms a quite long spur projecting anteriorly, leaving a deep groove between it and the upper part of the shaft. The radiogram of the section of the upper extremity of this femur is almost self-explanatory. (Fig. 11.) Vestiges of the normal internal structure are apparent. Such are the intermediary epiphyseal disk, some of the principal pressure trajectories, and some of the arches as well. The upper end of the bone is, however, merely a hollow shell, and expressive, it seems to me, not only of imperfect development, but of general atrophy also. As far as can be ascertained, this person was never able to maintain the upright position.]

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A DISCUSSION OF WOLFF'S LAW.[1]

By R. Tunstall Taylor, B.A., M.D.,

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We should feel much indebted to Dr. Freiberg for bringing the subject of Wolff's law, with its subordinate corollaries, before this Association, if for no other purpose than to promote a discussion of the thoroughness of its proof and its apparent impregnability.

[1] Read before the American Orthopedic Association, at Philadelphia, Pa., June 6, 1902.

To those of us who were fortunate enough to have read Wolff's first paper and his final article in the *Archiv für klinische Chirurgie*, or Freiberg's abstract in the *Annals of Surgery*, fruitful points of view were found for study of the etiological, pathological, clinical, and therapeutical problems that come under our observation.

To those of us, on the other hand, who are not familiar with this work, or who still cling to the theories advanced by Volkmann, Hueter, Roser, Lorenz, and others, known as the "pressure theory," blaming "superincumbent weight" and "atrophy" incident to it with many if not all of the deformities seen, Dr. Freiberg's present paper will at least make us think how much or how little we can apply these preconceived ideas to the pathogenesis of deformity, and how much we are indebted to Wolff for an entirely new aspect of the subject.

Many difficulties confront the majority of us in the study and proof of this law.

First, from a mathematical standpoint, how few of us are in a position to handle, as a well-known physicist put it to me, "the vector analysis, involving the N different variables," entering into the problem of joint motion, use, and function, there being no by-law rendering a Ph.D. acquired in higher mathematics or mechanics as an essential to fellowship in the American Orthopedic Association.

By means of such a "liberal education," to quote one of Dr. Gilman's favorite expressions, we would be in a position to discuss the mathematical and mechanical problem involved in the pressure, shearing stress, and tension trajectories of graphic statics in three dimensions, and Cullmann's discovery of the analogy in arrangement of the trabeculæ in the bone spongiosa and corticalis to his well-known drawing of the crane.

To most of us the mathematical side of this law must remain simply a point of interest, and one which we will not try to prove or disprove.

Second, in regard to the pathological proof.

Howard Kelly once said to me, "You orthopedic surgeons have no mortality in your cases!" This, in comparison with some of the other specialties, is in a sense true, and hence we have fewer opportunities to study the diseases or affections we are called upon to treat, post-mortem, pathologically than (shall I say?) some of our luckier brethren.

Even granting that our medical museums are well stocked with orthopedic preparations—which, alas! is far from the case—how few curators (or surgeons who own these necessarily valuable specimens) are keen to allow them to be cut into sections to study the trabeculæ of the spongiosa or measure the hyperplasia or diminution of the corticalis.

Third, from our training, reading, and preconceived ideas, how few of us are willing to discard entirely the theory of pressure or superin-

cumbent weight, especially in regard to the etiology of scoliosis, when most of our American authors at the present time—notably Bradford and Lovett, Whitman, Young and Judson, and such foreigners as Volkmann, Roser, Lorenz, Hoffa, Schreiber, Redard, and others—have advocated it; and many by experiment on the cadaver or vertebral column have produced a true rotary lateral curvature by superincumbent weight alone when function was, of course, a thing of the past. Whitman's is the only American text-book referring to Wolff's law, and this in an isolated way, and not applied to the diseases themselves.

Now it will be my aim to discuss Wolff's final paper more in detail, as upon it I have understood from Freiberg's abstract that his paper is based.

If we consider the mathematical postulate involved in Cullmann's tension and pressure trajectories of graphic statics, cannot we well question their accuracy if we consider the manifold directions and amount of force (*i. e.*, vectors) involved in the function, for example, of the hip-joint, with its numerous muscles and their dissimilar attachments and modes of action? *Apropos* of this, Wolff says himself, on page 837 of the article in question, replying to the criticisms of Hollander and Korteweg: "I also concede that the conditions in the live organism are much more complicated than they can appear in the mere observation of Cullmann's drawing. Many anatomical and mathematical researches will be necessary to complete our knowledge in this direction."

Atrophy undoubtedly, in its true sense, as shown in sections of diseased or morphologically changed bones and joints, does not take place, but an adaptive thickening of the corticalis and condensation of the spongiosa by transposition of burden-bearing; but can we agree absolutely with Wolff when he says this "cannot be due to pressure, but must be due to function?" Cannot pressure produce a condensation and thickening of bone as it does in the skin, as is shown by the callosities in the latter from pressure?

On pages 853 and 854 Wolff conclusively disproves that atrophy is the result of these conditions; and in his work in 1870 and Roux's observations on the "relation of the external shape to the internal architecture being dependent on the demands made on the part," their views were thoroughly substantiated by pathological evidence. But for the reason that he has found instead of an "atrophy," as the pressure theorists have called it, an osteosclerosis on the concave side of deformities, rendering this situation more suitable for "*burden-bearing*," for him to conclude that function has done it all and superincumbent weight none of it, seems to me open to question.

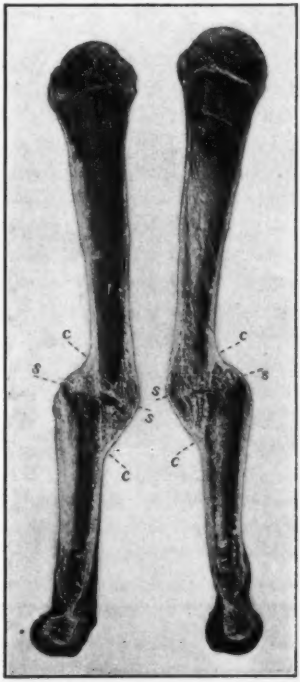
While no one will question, after the examination of pathological specimens, that the concave side of a bone or a series of bones acquires

a density or strength adapted to the burden-bearing required, can we say positively—leaving out the mathematical inferences—from the evidence (pathological) at hand, or as the logical conclusion of his arguments, that function is the only stimulus to this change unless we include both burden-bearing (otherwise called superincumbent weight) and pressure, to which he later adds accommodation to space, under the generic name of function?

In the third chapter, headed "Clinical Observations," Wolff goes on to state that because we find pathologically that both the internal architecture and configuration are changed, and the external form as well, in deformities, that these deformities are caused by and are the result solely of a functional transformation of bone, whether in the "narrower or wider sense of the term;" yet he goes on to state that "the shape of the bones and joints of the deformed part represents nothing else than the expression of a functional accommodation to the faulty *static demands* made upon it."

It seems to me, therefore, that the "static demands," or what we are wont to call vicious or unavoidable attitudes, cause deformities, and the functional bone transformations simply intensify them.

FIG. 1.



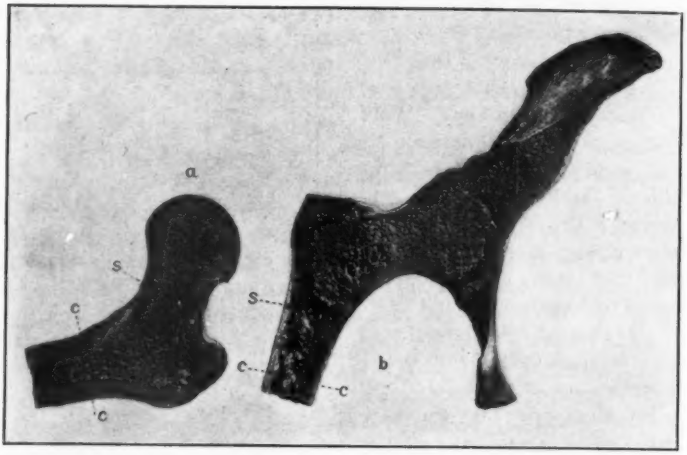
Sections showing deformity following malunion of the humerus. *c*. Thickening of the cortex at the concavity. *s*. Thinning of the cortex and greater porosity of the spongy portion of the convexity of the deformity.

He mentions—and we are all familiar with cases of beginning scoliosis without bony change—and would anyone of us expect either the formation of the "scoliotic wedges" or torsion in the vertebræ if superincumbent weight were removed by the habitual recumbency of such an early case of lateral curvature? and, *vice versa*, in such a case, if superincumbent weight were allowed to act continuously, which of us would not fear the pathological changes named?

Further, in a severe case of congenital talipes equino varus before

the child has walked we consider it a deformed foot, but there may be no functional use nor bony change. Wolff says the transformation of bone constitutes deformity, and this transformation is necessary to

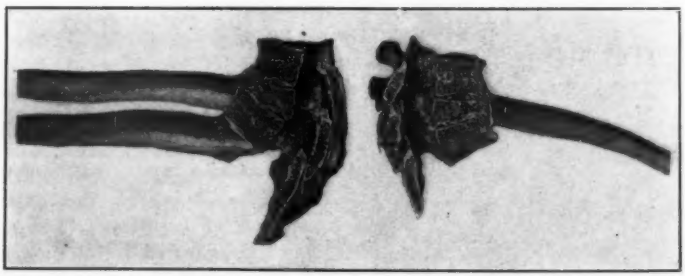
FIG. 2.



Sections of femora: (*a*) Normal; (*b*) tuberculous ankylosis. *a*. Cortex thick at *c c*, with regular trabeculæ in spongiosa at *s*. *b*. Cortex thin at *c c*, with irregular trabeculæ in spongiosa at *s*.

function. This we can accept generally, but can we agree with his statement that in all cases the pathogenesis of deformities is functional?

FIG. 3.



Sections showing ankylosis of vertebral bodies following tuberculous spondylitis (Pott's disease). No marked change in thickness of cortex to meet new functional demands.

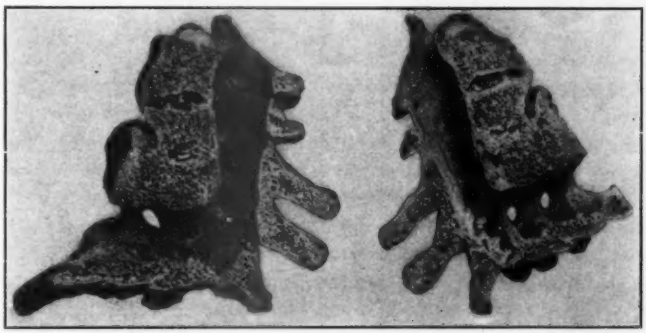
Wolff is correct, so far as we know, in that there is no pathological evidence of an osteomalacia or bone softening in the scoliotic deformi-

ties of adults and the bed-ridden; but cannot we find muscular contractures from various causes producing bone pressure, with ultimate deformity?

Wolff, speaking of the "scoliotic wedge," acknowledges that "pressure from the outside" deprives bone of space to grow in, and hence causes trabeculæ to be formed in abnormal positions and directions. Why should "pressure from the outside" produce such results and pressure from above not do the same thing?

Could we not consider the so-called "atrophy" on the concave side of the scoliotic wedge or the external condyle of genu valgum rather an osteosclerosis or condensation, and on the opposite side an osteoporosis, as better terms, whether due to superincumbent weight or "a functionally limited space to grow in," as Wolff puts it, or, better still, due to both?

FIG. 4.



Sections showing rectangular deformity of spine following Pott's disease, with no narrowing of the lumen of the spinal canal. No marked change is seen in the trabecular arrangement of the corticalis or spongiosa.

In conclusion, I consider that all of us must concur fully with Wolff that pressure does not produce atrophy in bone, as Lorenz has claimed, under pathologically increased or transposed burdening; and also we must admit that functional transformation of bone must and does occur to meet the altered static demands of pressure, tension, and shearing strain.

On the other hand, I am not in a mental attitude—perhaps from incomplete study of this problem or from Wolff's arguments not being clearly logical to me—to admit that we can attribute all deformities to function alone, regardless of superincumbent weight.

That we can have, however, some deformities from functional demands and a functional transformation of bone I do admit, as is

shown in the mal-union of a fractured humerus submitted herewith (Fig. 1), in which, of course, superincumbent weight plays no part and function is the causative factor.

On the other hand, the specimen of ankylosis of the hip-joint shows no additional lamellæ on the concave side of the femoral neck, as we

FIG. 5. FIG. 6.

FIG. 5.—Sections showing deformity following mal-union of tibia and fibula. *c*. Functional bone transformation, as in Fig. 1.

FIG. 6.—A scoliotic vertebra. *t*. Torsion of the lateral arches and spinous process is seen. *p*. Growth to the right of the vertebral body, with approximation of its superior and inferior planes on the right side ("scoliotic wedge"). *c*. Osteosclerosis of cortex, to meet the "functional demands" of "superincumbent weight."

would expect, nor condensation of the spongiosa. The trabecular arrangement is altered, however. (Fig. 2.) The specimen of ankylosis of Pott's disease shows but little increased tissue density on the concavity of the curve. (Figs. 3 and 4.) Wolff's functional transforma-

tion is also shown in the specimen of mal-union of tibia and fibula (Fig. 5) and in that of the scoliotic vertebra. (Fig. 6.)

Finally, from a therapeutic standpoint, Wolff's law would seem to teach us the reason for the importance of *overcorrection* in genu varum and valgum, after operation, to promote bone tranformation; also hyperextension in Pott's disease; a fixation position or exercises of *overcorrection* in scoliosis and its application to the correction of conditions like coxa vara, to strengthen weak points in the femoral neck by operation, assisted by functional conformation to meet static demands.

Finally, additional research along this line of thought by different observers would be most helpful to either establish finally Wolff's law or point out its limitations.

THE SURGICAL TREATMENT OF CIRRHOSIS OF THE LIVER, WITH A SUMMARY OF REPORTED CASES.

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Few subjects in modern medicine have aroused more interest than the comparatively recent proposal to bring cirrhosis of the liver within the scope of surgical relief, and a comparatively large number of cases have already been reported in which the operation has been performed with varying success. As with many new operations, it has been enthusiastically applied to conditions for which its originators did not intend it, and has suffered in consequence in its professional reputation. The operation, however, has now gone beyond the experimental stage, and a just estimate of its value should be possible from the cases reported. Such an estimate, so far as the published details of cases go, is here offered for consideration.

To Talma, of Utrecht, belongs unquestionably the claim of priority in this procedure, but to Morrison and Drummond, of Newcastle, must be conceded the first practical demonstration of the success of the operation, and its presentation as a reasonable surgical procedure. Talma's theory of operation was based upon his observation at autopsy that cases of liver cirrhosis which showed the least ascites were those in which abundant anastomoses existed, through the pre-existing channels, and through accidental adhesions between the vessels of the portal system and those of the systemic circulation. By increasing the adhesions he hoped to increase the anastomoses and thus diminish the portal congestion. Drummond and Morrison conceived the same idea, quite independently of Talma, and proceeded to put their plan to prac-

tical test. Both of these theories, however, were based upon the mechanical theory of the production of ascites in liver cirrhosis, and were intended to relieve the portal congestion and particularly the symptom of ascites. No one expected to affect in any way the changes which had already occurred in the liver, or in other organs, except so far as to prevent further progress of the disease by establishing by adhesions a more efficient blood supply to and from the liver and the spleen, and thus aiding in the recuperation of the tissues which were not already destroyed beyond repair.

In 1891, however, Terrier, of Paris, performed an operation of an entirely different nature from that of Talma or Morrison for the relief of the condition known as biliary or Hanot's cirrhosis. Terrier's operation, which was later taken up by Delageniere, of Mans, and made popular by him, is commonly spoken of as Delageniere's operation, and some confusion has existed between this procedure and Talma's operation. The two operations, however, are fundamentally different—Delageniere's being based upon the theory, which obtains in France, that hypertrophic or biliary cirrhosis is due to an infection of the bile-ducts proceeding from the intestine. Drainage of the bile-ducts is obtained by cholecystostomy and the maintenance of a biliary fistula. Guillot[65] cites five instances of this condition where culture showed a bacterial infection of the bile-ducts, generally by the colon bacillus, and considerable evidence is presented in support of the angiocholitic origin of biliary cirrhosis. Guillot collected thirteen cases in which the operation of cholecystostomy was performed, ten of which were successful in relieving the disease. To this number four more cases may be added up to the present time, or seventeen cases, thirteen of which were relieved.

TABLE I.—CASES OF BILIARY CIRRHOSIS AND ANGIOCHOLITIS.[64 65 67]

	Operator.	*Date.*	*Operation.*	*Result.*
1.	Terrier	1891	Cholecystostomy.	Recovery.
2.	Le Dentu	1892	"	Died.
3	Quenu	1892	"	No improvement.
4.	"	1895	"	"
5.	Delageniere	1896	"	Recovery.
6.	"	1897	"	"
7.	Michaux	1896	"	"
8.	Delageniere	1898	"	"
9.	"	1899	"	"
10.	"	1899	"	"
11.	Bossowski	1900	"	Improved.
12.	Panchet	1900	"	Recovery.
13.	Lejars	1900	"	"
14.	Delageniere	1900	"	"
15.	"	1900	"	"
16.	Terrier	1900	"	Died.
17.	"	1900	"	Recovery.

It must be said that adhesions between the gall-bladder and the abdominal wall fulfil to a certain extent the conditions of Talma's

operation, but with this exception, the two operations are entirely different and not susceptible of comparison. Three of the thirteen cases relieved, however, presented the symptom of ascites, and it is probable that some fatty enlarged livers of alcoholic cirrhosis are included in this list of cases.

The operation of cholecystostomy and drainage of the bile-ducts is thus seen to promote recovery in a considerable number of cases of enlarged liver. Cases of cure of this condition without operation other than exploratory laparotomy have been reported by Routier, Hartmann, Delbet, Quenu, Segonde, and Faure,[64] and may be taken as indicating that the condition is not one entirely hopeless without surgical relief. The number of reported cases is too few, however, and the pathology of the condition too little understood for definite deductions to be made concerning the value of operation in this disease. Such evidence as exists seems to show that surgical interference in a certain proportion of cases is justified and gives promise of relief. A larger number of observations will be necessary before more definite conclusions can be drawn.

Talma's operation, or suture of the omentum for the relief of ascites, depends, as has been said, upon the theory that the ascites in liver cirrhosis is of mechanical origin. This theory has been generally accepted, but a certain number of observers have contended that the toxæmia resulting from the destruction of liver cells is responsible for the ascites. The tendency to the development of œdema of the legs and feet is cited in support of this latter view, and although attributed by many to pressure of the ascitic fluid upon the vena cava, occasionally occurs independent of ascites. It seems to the writer not impossible that the two factors may be combined, the toxæmia exerting its influence and producing exudation at the point of least resistance —*i. e.*, the already obstructed portal circulation.

Thompson[62] and Hale White[63] bring a new factor into consideration by advancing the theory that ascites in liver cirrhosis, particularly if of long duration, may be due to purely accidental co-existing causes such as chronic peritonitis or perihepatitis. White cites autopsy reports in support of his contention to the effect that of ten cases of cirrhosis with ascites which survived more than one tapping, four were proved at autopsy to have no cirrhosis and six to have had peritonitis in addition to cirrhosis. It must be remembered in this connection that the large number of lymphatic openings on the under surface of the diaphragm would be obliterated by a peritonitis in this region, and the normal facilities for the absorption of peritoneal lymph thereby diminished. Another point, however, must be considered in connection with Hale White's cases, and that is that the chronic peritonitis which he observed at autopsy in his six cases of cirrhosis may well have been

in part itself produced by the numerous tappings which had been performed.

The classical experiments of Eck[53] established the fact that diversion of the portal blood before its passage through the liver into the systemic circulation was accompanied by symptoms of toxæmia and by almost uniformly fatal results. Some of the products of digestion seem to need to be elaborated by the liver cells before they can be safely received into the general circulation. An excess of carbaminic acid, one of the supposed precursors of urea, was thought to be the exciting cause of these toxic symptoms by Hahn,[57] as a result of his experiments. Toxic symptoms of this nature may arise in two ways: (1) By destruction of liver cells; (2) by over-abundant anastomosis and consequent short-circuiting of the liver. From the first cause they are probably not uncommon in terminal stages of many cases of cirrhosis. From one or both of these causes symptoms of toxæmia have been noticed in at least four cases after Talma's operation, although in such cases readily controlled by diminution of proteid diet.

Experimental operations on dogs have been performed by at least three observers—Tillman[54] Kusnetzow,[56] and Pascale.[55] They have proved that after suture of the omentum a dog will survive the gradual cutting off of the branches of the portal vein, whereas a fatal result occurs if the omental anastomosis has not been first secured. Care must be taken, however, in applying the results of experiments on healthy dogs to operations performed upon patients suffering with cirrhosis of the liver, because of the pathological changes of bloodvessels, heart, kidney, spleen, and other organs which so frequently accompany this disease.

The anastomoses commonly found to exist between the portal and the general systemic circulation are given by Frazier[18] as follows:

1. The coronary with the œsophageal and azygos veins.
2. The vessels of the cæcum and colon with the internal mammary branches.
3. The hemorrhoidal with the hypogastric vessels.
4. The vessels in the hepatic ligament and in Glisson's capsule.
5. The umbilical or para-umbilical vein in the round ligament with the epigastric vessels.

The number of reported cases of Talma's operation for ascites which I have been able to collect from all sources up to May 5, 1902, amount to 122 cases. This number does not include the following cases which have been rejected for not fulfilling all the necessary conditions of this analysis: 1. The case of Ries,[51] no ascites, Talma's operation for hemorrhage in cirrhosis, successful in that hemorrhage did not recur, but time elapsed not stated. 2. The case of Bossowski,[50] and one of Delageniere,[67] operation of cholecystostomy (see biliary

cirrhosis). 3. The case of Willems,[52] no ascites, enlarged liver and spleen in a child aged five years, Talma's operation and diminution of liver dulness, twenty-four days after the operation. 4. Three cases of Markoe and one of Dwight where exploratory laparotomy alone was done.[38] 5. The case of Tansini,[53] where Talma's operation was done in addition to splenectomy for so-called Banti's disease, splenomegaly and liver cirrhosis, ascites present, condition improved after lapse of one month. 6. The case reported by Kümmell,[45] in which exploratory laparotomy in a case of cirrhosis was followed by relief to the ascites; the author attributed this relief to probable inclusion of the omentum in the wound, but proof of this was not apparent.*

Of the 122 cases collected, 94 are gathered from the literature in more or less detail, and 23 are taken from the paper of G. E. Brewer,[38] where they were reported in tabular form, being derived from personal communications made to him by the surgeons who operated upon them. Five other cases are here reported for the first time. The total number of cases available for analysis thus amounting to 122.

In the first place the operation as suggested by Talma and Morrison was intended for the relief of ascites in cirrhosis of the liver. It has been applied, however, to many cases of ascites due to other causes, for which in the minds of its originators it was never intended. This has occurred in some cases through errors of diagnosis, and in others through the intentional application of Talma's operation to ascites of any sort. Two cases of adherent pericardium were operated upon, 1 a case of mistaken diagnosis and reported as such (Case 108), the error being discovered at autopsy one year later, no improvement having resulted from the operation; the other being alive and free from ascites two years after the operation (Case 27). One case (Case 52) of ascites of cardiac origin died shortly after the operation. Four cases of ascites thought to be due to renal disease were operated upon. One was improved after seven months (Case 51), and three died within six weeks (Cases 20, 22, and 23). Six other cases showed evidence of renal disease and have been taken from among the number of presumably uncomplicated cirrhosis cases. One (Case 6) was alive and had no ascites two years after the operation, and 5 (Cases 8, 32, 40, 61, and 63) died within two weeks. Two cases are reported in which the ascites was due to chronic peritonitis (Cases 12 and 13). Both died without improvement before six months.

Two other cases are recorded in which the ascites was due to disease of the liver other than cirrhosis, and these cases also have been with-

* The cases reported by Bunge[46] at the Thirty-first German Surgery Congress (American Medicine, May 3, 1902, p. 720) were not published in sufficient detail to be of value. The paper by Eyselsteyn,[47] ten cases, and those of Dalmastri[48] and Landrieux[49] were not obtainable in the originals.

drawn from the uncomplicated cases. One of echinococcus (Case 10) died in four days, 1 of "tuberculous cirrhosis" with undoubted tuberculous peritonitis (Case 70) slightly improved after one year. Three cases of malarial cirrhosis are reported (Cases 29, 66, and 72). This is a condition apparently found more frequently in Italy than elsewhere, but good authority vouches for its existence and states that ascites may result (Hoppe-Seyler). Of the 3 cases, 2 showed no improvement, and one slight improvement several months after operation. Three cases of probable syphilitic cirrhosis are recorded, 1 improved five months after operation (Case 14); 1, no improvement and death in nine months (Case 45); and 1 relieved of ascites, but dying five months later of hemorrhage (Case 50).

The cases of malarial and syphilitic cirrhosis have been included with those of presumably alcoholic cirrhosis as being essentially of the same character. The cases of ascites due to other causes, however, as above described, 17 in number, have been deducted. There are thus left for consideration 105 cases in which at least no good evidence exists to show that we are dealing with other than uncomplicated liver cirrhosis.

Serious deficiencies in the published details of cases are evident, as remarked by Brewer. Such details as are given, however, are here presented.

Of 105 cases, 31 (29.5 per cent.) died within thirty days of the operation; 44 reported improved or slightly improved after the operation (42 per cent.), and 29 (27.6 per cent.) showed no improvement. One case could not be traced. Thus 60 cases (57.1 per cent.) obtained no benefit from the operation.

Forty-four cases are reported to have shown improvement after the operation. This statement is made, as a rule, by the surgeon reporting the result, and may be understood as applying especially to the symptom of ascites. Four among this number (Cases 48, 50, 88, and 116) were relieved of ascites, but died within five months after the operation, of toxæmia, hemorrhage, myocarditis, or unstated causes. These cases although relieved of ascites cannot with propriety be considered as successful results. The amount of time elapsed between the operation and the report of improvement also varies widely, and a considerable number of cases are reported far too soon to allow any estimate of value with regard to the ultimate effect of the operation. Thus, 2 were reported improved before one month had elapsed, 7 between one and three months, 12 between three and six months, and 12 over six months. In 11 cases the actual time elapsed is not stated; 9 cases, however, lived two years after the operation and were then improved (8.5 per cent. of the whole number). It would be manifestly unjust to deny that a case apparently improved three or six months after the

operation might not be permanently relieved, and perhaps more unjust when the time elapsed is not stated. To accept such cases as cured, however, in view of the fact that 16 cases at least of those surviving the operation died from one to twenty-four months later, seems equally unwarranted. For this reason the cases of apparent improvement have been stated to be 44, while those of lasting relief have been reduced to 9.

An analysis of the 9 cases improved after the lapse of two years is of interest. The duration of symptoms before operation was not stated in 3, 2 were of two months duration, 1 six and 1 fifteen months, 1 two years and 1 ten years. Tappings before operation not stated in 3, none in 1, one or more taps and several taps each 1 case, 1 was tapped twice, 1 five and 1 nine times. The condition of the liver was atrophic in 5 cases, cirrhotic in 2, and not noted in 2 cases. Adhesions were present in 1 case, œdema of the feet in 3 cases; 2 had partial return of the ascites after operation, and 1 of these had to be tapped once, but the fluid did not return. One case died after the two years were up of gastroduodenal catarrh, but with no other symptom of cirrhosis. Another died of operation for ventral hernia which followed the first operation. The consideration of the reported details of these 9 cases, therefore, gives no light upon the important question of the reason for their successful outcome as compared with the lack of success in the majority of cases of operation.

In assembling the statistics of this operation it has seemed important to ascertain, so far as possible, which cases offer the most promise of success, and which the least. The condition of the liver was not recorded in 53 of the 105 cases; in 15 the liver was enlarged, and in 37 it was atrophic. Of the 15 cases of enlarged liver, 3 died (20 per cent.), and 9 were improved (60 per cent.). Of the 37 atrophic cases, 11 died (29.7 per cent.), and 13 were improved (36 per cent.), a decidedly better outlook for the cases with enlarged liver.

The contention of Thompson[62] and Hale White,[63] that the cases which survive several tappings are those in which the ascites is due to or increased by a perihepatitis, has great interest in the surgical consideration of these cases. At first glance it might be supposed that the artificial production of local peritonitis, if the ascites were due to such a process would aggravate rather than ameliorate the condition. It is conceivable, of course, that complete adhesion, by closing the cavity entirely, might prevent the re-accumulation of the ascites. Such a case has, indeed, been recently reported by Dalton,[58] in which five years of relief from ascites were due to this cause, as proved by autopsy after death from strangulated hernia. It seems unlikely, however, that any aseptic operation, however thorough, could produce such complete obliteration of the peritoneal cavity as this demands. In these 105 cases of cirrhosis,

adhesions or perihepatitis were noted in only 8 cases, 5 of which received benefit from the operation (62.5 per cent.). In 13 cases the fact that the peritoneal surface was normal was recorded, and of this number, 6, or 46 per cent., were improved. The numbers are too small for the purpose of drawing definite conclusions, but they suggest that the presence of adhesions gives a better prognosis, and that operation in such cases does not aggravate the condition. It was, indeed, such cases of adhesions that suggested the possibility of operation to Talma and to Drummond.

In this connection, it may be said that of 12 cases not tapped more than once before operation, 50 per cent. were improved, and of 35 cases which were tapped twice or more, 42.8 per cent. were improved. The difference is too small to be of importance in prognosis, but the figures are at least evidence that it is not alone the cases of long-standing and continued tapping which have benefited by the operation. Œdema of the feet and legs was reported present in 22 cases; 11 of these, or 50 per cent., were improved after operation. In the 83 other cases in which œdema was absent or not recorded 33 were improved (40 per cent.). Œdema of the feet can, therefore, not be regarded as of especially bad prognostic import.

The technique of operation has been varied to suit the taste of the individual operator in many instances, and not enough operations after any one method can be collected to form an estimate of the value of any one procedure. Talma recommended the suture of the omentum to the margin of the abdominal incision, and the irritation of the peritoneal surface of liver and spleen. Morrison sutured the omentum and rubbed and scratched the peritoneum over liver, spleen, and abdominal wall in order to obtain more extensive adhesions. Turner sutured the omentum between the liver and the diaphragm and further sutured the liver to the abdominal wall. Schiassi and other Italian surgeons have placed the omentum spread out between the layers of the abdominal wall, either between peritoneum and muscle or between the muscular layers. Several operations of this nature have been done in this country. Of 68 cases of suture of the omentum combined with rubbing of the peritoneal surfaces to a greater or less extent, 22 died (32.3 per cent.), and 28 were improved (41 per cent.). Of 23 cases where the omentum was spread out between the layers of the abdominal wall, 4 deaths occurred (17.3 per cent.), and 10 cases were improved (43.4 per cent.). This modification of the original operation, therefore, gives slightly better results without increasing the mortality of the operation.

The operation has been done with ether, chloroform, and cocaine anæsthesia. Sufficient details are not given to allow of a report of the comparative merits of these anæsthetics. Two cases are reported in which the operation was begun under cocaine, but ether had to be

administered, in order to complete the operation. A number of surgeons express themselves as opposed to the use of ether on account of the liability to renal disease among these cases.

Drainage was employed in 20 cases, with 10 deaths (50 per cent.). The wound was closed without drainage in 34 cases, with a mortality of only 5 (14.7 per cent.). These figures bear out the opinion of Weir, Brewer, and several other surgeons, who are opposed to drainage on account of the danger of infection. Of 6 cases which died of peritonitis or sepsis within thirty days of operation, 4 were drained, and in the other 2 the details of operation were not stated. The application of tight plaster strapping to the upper abdomen after operation as recommended by Morrison seems to meet with general acceptance.

Thirty-one cases died within thirty days of operation. The causes of death in these cases were as follows: shock, 4 cases (one of these was operated upon also for umbilical hernia); sepsis, 1 case; peritonitis, 5 cases; toxæmia, 2; uræmia, 1; exhaustion, 5; hemorrhage, 1; pneumonia, 1 (umbilical hernia operated upon at the same time); pleurisy, 1; intestinal obstruction, 2, and unknown cause, 8. Sixteen other cases died without improvement after the operation at a longer interval than thirty days; in 12 the cause of death was not stated. In 3 the cause of death was toxæmia, and in 1 case, phlebitis and embolism of lung. Seven other cases are now dead—2 after two years of relief, 1 of operation, and the other of gastroduodenal catarrh, and 1 after one year of relief, of erysipelas. Four cases died presumably of cirrhosis or its complications, but with relief to the ascites for which they submitted to operation. It is to be noted that the cause of death is given in 2 cases as due to intestinal obstruction. This danger is one of the reasons which has been urged against the operation. In 1 other case, where death occurred nine months after the operation without improvement, impacted feces were found in the colon and were attributed to partial obstruction due to the adhesions. The danger of intestinal obstruction following this operation is thus a real one, although extremely rare.

Summary. 1. The condition known as biliary cirrhosis, with enlarged liver, jaundice, and fever and without ascites, is accompanied in a certain proportion of cases by an infection of the bile-ducts. The drainage of the bile-ducts by cholecystostomy is a proper operation for the relief of this condition when evidence of infection is present and symptomatic treatment has failed to effect relief.

2. Of 105 cases of liver cirrhosis which presented the symptoms of ascites, 42 per cent. were improved and 58 per cent. not improved by Talma's operation or one of its modifications. The mortality within thirty days was 29.5 per cent. Nine cases were improved in health two years after the operation.

3. The nine cases of continued relief presented no marked differences from the general character of all the cases.

4. The cases in which the liver was enlarged gave a lower mortality and a higher percentage of improvement than cases of atrophic liver.

5. Cases of suture of the omentum between the layers of the abdominal wall gave a lower mortality and a slightly higher percentage of improvement than cases where only peritoneal surfaces were brought in contact.

6. Drainage increases the danger of septic infection and peritonitis and is to be avoided. If necessary, tapping may be done after the operation.

7. The presence of adhesions or perihepatitis is of good prognostic import as regards the success of the operation.

8. The number of tappings before operation and the presence of œdema of the feet and legs are of less prognostic importance than the general condition of the patient, the size of the liver and the functional activity of the liver cells.

9. Talma's operation or one of its modifications is of proved benefit in a certain limited number of cases of liver cirrhosis; primarily for the relief of ascites, and secondarily for the relief of other symptoms of portal congestion.

10. The dangers attending the operation are mainly due to the weakened resistance of the patient, rather than to the operation itself. The selection of cases suitable for operation demands more judgment than has been exercised hitherto.

11. The operation is not indicated in cases of ascites due to causes other than cirrhosis of the liver.

12. The operation is contraindicated in the presence of renal or cardiac disease and when good evidence does not exist that sufficient functional liver tissue remains to maintain life. It is also contraindicated when complications exist sufficient in themselves to make the result of operation uncertain.*

* The paper of Ito and Orni (Deutsche Zeitschrift für Chir., lxii. p. 141), (Centralblatt für Chir., 1902, 15, p. 417), five cases, and that of Harris (Journ. Amer. Med. Assoc., May 3, 1902, p. 1137), five cases (2 Harris, 1 Lee, 1 Oswald, and 1 McArthur), were obtained too late for incorporation in this table. The summaries of these cases follow:

1. Ito and Orni. Malarial cirrhosis, jaundice, ascites four months duration, spleen enlarged; suture, adhesions present, no drainage. Recovery; no improvement. Died in three months.

2. Ibid. Cirrhosis, enlarged liver and spleen, ascites (slight); suture. Recovery; improvement one year.

3. Ibid. Alcoholic atrophic liver, enlarged spleen three years duration, ascites tapped once; suture (Schleich), drainage twenty-four hours. Died in five days.

4. Ibid. Syphilitic case, jaundice, ascites; tapped once; suture. Recovery; no improvement. Died in four and a half months.

5. Ibid. Syphilitic liver slightly enlarged, œdema of feet, ascites; tapped eight times; suture. tied in four days.

6. Harris. Atrophic liver, enlarged spleen, ascites, jaundice; duration one year; tapped

Summary of Cases.

1. Van der Meule, 1889. Talma operation. Death in a few hours from shock.[1]

2. Schelkly, 1891. Talma operation. Atrophic liver and ascites. Death in fourteen days from peritonitis.[1]

3. Lens, 1892. Atrophic liver and ascites. Talma operation; no improvement. Died in six months.[1]

4. Drummond and Morrison, 1894. Enlarged liver, ascites, and œdema of feet, twenty months duration; tapped forty-eight times, Morrison operation; drainage; no improvement. Died in nineteen months.[4]

5. Ibid., 1895. Atrophic liver, enlarged spleen, ascites, œdema of feet, six months duration; tapped five times, Morrison operation; drainage; recovery and improvement. Two years later died of operation for ventral hernia.[4]

6. Eiselsberg and Talma, 1896. Renal disease, enlarged spleen, atrophic liver, ascites and œdema, two months duration; tapped six times; suture of omentum and gall-bladder; second operation (Narath) for spleen. Recovery after two years.[2]

7. Morrison, 1897. Atrophic liver, enlarged spleen, ascites, eight weeks duration; not tapped; Morrison operation; drainage. Recovery; improved after two years; toxæmia from meat diet.[5]

8. Ibid., 1897. Renal disease, ovarian cyst, atrophic liver, enlarged spleen, ascites, œdema of feet, eighteen months duration; tapped once, Morrison operation; no drainage. Died in eleven days from uræmia.[5]

9. Narath and Talma, 1898. Cholæmic case, enlarged liver and spleen, ascites, and œdema of feet, several months duration; tapped three times: adhesions, suture, no drainage. Recovery with much improvement, six months; toxæmia from meat diet.[3]

10. Weir, 1898. Echinococcus of liver, enlarged spleen, ascites; no œdema, two years duration; tapped twelve times, suture, perihepatitis, drainage. Death in four days, peritonitis.[6]

11. Neumann, 1898. Enlarged liver and spleen, ascites, no œdema, short duration; not tapped, suture, no adhesions, no drainage. Recovery; improved, six months.[7]

12. Narath and Talma, 1899. Chronic peritonitis, chylous ascites, atrophic liver, œdema of feet, three months duration; tapped five times, suture, no drainage; no improvement. Died in five months.[3]

13. Folmer and Talma, 1899. Chronic peritonitis, enlarged liver, ascites, and œdema of feet; two months duration; tapped three times, suture, no drainage; no improvement. Death in six months.[3]

14. Rolleston and Turner, 1899. Syphilitic, atrophic liver, enlarged spleen, ascites, and œdema; tapped once, Turner operation, no adhesions, no drainage. Recovery; improved, five months.[6]

15. Ibid., 1899. Atrophic liver, ascites, and œdema, two months duration; tapped once, Turner operation, no drainage. Recovery; no improvement, four months.[6]

16. Grinon, 1899. Cirrhotic liver, ascites; tapped seven times, intramural operation, no drainage. Recovery; improved, two months.[10]

17. Babroff and Chervinski, 1899. Atrophic liver, enlarged spleen, ascites, four months duration; suture, no drainage. Recovery; improved, three and a half months.[11]

18. Frazier, 1900. Atrophic liver, enlarged spleen, ascites, and œdema; tapped five times; suture, no drainage, omentum thickened. Recovered; improved, three months. Tapped twice after operation.[12]

19. Packard and Le Conte, 1900. Atrophic liver, enlarged spleen, ascites, and œdema, five

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nine times; suture; omentum thickened; no drainage; no improvement; cerebral hemorrhage. Died in three weeks.

7. Ibid. Alcoholic atrophic liver, spleen enlarged, four months duration, ascites, œdema of feet, arterio-sclerosis; suture, no drainage. Recovery; no improvement. Died two months.

8. Oswald. Alcoholic atrophic liver, spleen enlarged, ascites, œdema, slight jaundice; suture, no drainage. Recovery; no improvement. Died in six weeks.

9. Lee. Duration one year, ascites, tapped once, œdema; suture, no drainage. Recovery; no improvement. Died in ten weeks.

10. McArthur (see also Annals of Surgery, 1901, vol. xxxiii. p. 653). Alcoholic cirrhosis four months duration, ascites; tapped four times; suture. Recovery; improved. No ascites thirteen months later.

The addition of these ten cases to the previous 105 makes 115. Died in thirty days 34, 46 improved, and 34 no improvement. Died 29.5 per cent., improved 40 per cent, no improvement 29.5 per cent.

years duration; tapped four times, suture, drainage, no adhesions. Recovered; no improvement; died in two months, toxæmia.[14]

20. Ibid., 1900. Renal disease, enlarged liver, spleen not enlarged, ascites, and œdema of feet, ten years duration; tapped once, suture, drainage, no adhesions. Died in four days, from uræmia.[14]

21. Muscroft and Ingalls, 1901. Jaundice, atrophic liver, ascites, and œdema; tapped once, suture, drainage. Died in thirty hours.[28]

22. Roberts, 1900. Renal disease, question of sarcoma of liver, ascites, three months duration; suture, no drainage; no improvement. Died in six weeks.[15]

23. Ibid., 1900. Renal disease, atrophic liver, ascites, and œdema, eight months duration; tapped nine times, suture, no drainage. Died in twenty-four hours from uræmia.[15]

24. Benisowitch, 1900. Enlarged liver and spleen, ascites, several months duration; tapped three times; suture, no drainage, no adhesions. Recovery; slight improvement in six months. Tapped once after operation.[17]

25. Ibid., 1900. Case of advanced cirrhosis, ascites, three years duration; tapped three times, suture, no drainage. Died in two weeks.[17]

26. F. T. Brown, 1899. Atrophic liver, enlarged spleen, ascites, and œdema, fifteen months duration; tapped nine times, suture, drainage, omentum adherent. Recovery, improved, 26 months.[10]

27. Schiassi, 1898. Pericardial adhesions, question of cirrhosis, ascites, duration two months; tapped twice, intramural operation, no drainage. Recovery, improved, two years.[19]

28. Ibid., 1899. Cirrhosis, enlarged spleen, ascites, ten years duration; tapped once or more, intramural operation, no drainage. Recovery, improved, two years; toxæmia with meat diet.[19]

29. Ibid., 1900. Malarial cirrhosis, ascites, and œdema; intramural operation, no drainage. Recovery; no improvement.[19]

30. von Ssokolow, 1901. Atrophic liver, ascites, three years duration; tapped once, suture, no drainage. Recovery, improvement, four months.[20]

31. Bucco, 1901. Cirrhosis, ascites; intramural operation. Recovery, improvement eight days later.[41]

32. Brewer, 1899. Renal disease, atrophic liver and enlarged spleen, ascites several weeks duration; tapped once, suture, drainage, no adhesions. Death in two days from uræmia.[26]

33. Ibid., 1899. Atrophic liver, enlarged spleen, ascites, two to three months duration; suture, no adhesions, drainage. Death in twenty-four hours from shock.[26]

34. Ibid., 1900. Atrophic liver, enlarged spleen, ascites; not tapped, no adhesions, suture, drainage. Death in five days from peritonitis.[26]

35. Ibid., 1901. Atrophic liver, enlarged spleen, ascites, several months duration; not tapped, suture, no adhesions, no drainage. Recovery, improved, three months. Tapped twice after operation.[26]

36. Ibid., 1901. Atrophic liver, enlarged spleen, ascites, two months duration; suture, adhesions, drainage. Death in one week from peritonitis.[26]

37. Koslowski, 1901. Cirrhotic liver and ascites; suture. Recovery; no improvement.[16]

38. Commandini and Salvolini, 1899. Atrophic liver, enlarged spleen, ascites, and œdema, several months duration; tapped three times, suture, drainage. Death in a few days.[32]

39. Annovazzi and Parma, 1900. Atrophic liver, enlarged spleen, ascites, and œdema, three months duration; not tapped, suture, no drainage. Recovery, improved, sixteen months. Tapped three times after operation.[32]

40. Torrance, 1901. Renal disease (?), atrophic liver, enlarged spleen, ascites, and œdema, six months duration; tapped three times, suture, no adhesions, no drainage. Died in four days of uræmia.[40]

41. Raffa and Dozzan, 1901. Atrophic liver and ascites; suture, no drainage. Recovery; no improvement. Died in eleven months.[31]

42. Clementi, 1900. Case recovered without improvement.[31]

43. Ibid., 1900. Case recovered from operation; no improvement.[31].

44. Jelks, 1900. Ascites, six months duration; tapped twice, suture, no drainage. Recovery, no improvement. Died in three months of toxæmia.[27]

45. Roe and Spencer, 1900. Syphilis, atrophic liver, normal spleen, ascites, two and a half years duration; tapped thirty-two times, intramural operation, thickened peritoneum, no drainage. Recovery, no improvement. Died in nine months; question of partial obstruction to colon.[39]

46. Ballin, 1900. Ascites and œdema, two years duration; tapped three times, suture, no drainage. Recovery, improved, five months.[33]

47. Wyman, 1900. Cirrhosis, ascites, œdema, two months duration; tapped twice, intra-

mural operation, no drainage. Recovery, improved, over two years. Died of gastroduodenal catarrh. Tapped once after operation.[22]

48. Ibid., 1901. Enlarged liver, ascites; tapped twice, intramural operation, no drainage; Recovery, ascites did not recur. Died three months later of toxæmia.[23]

49. Ibid., 1901. Ascites, one and a half years duration; intramural operation, no drainage. Recovery; ascites did not recur, general health no better.[12]

50. Bidwell, 1900. Syphilis, cirrhosis, ascites; suture, no drainage. Recovery; ascites cured. Died in five months of hemorrhage.[24]

51. Ibid., 1901. Renal disease, ascites, and œdema, liver slightly enlarged; tapped six times, suture, no drainage. Recovery, improved, seven months.[24]

52. Ibid., 1901. Cardiac disease and ascites, œdema, liver enlarged; suture. Recovery; died "shortly" of syncope.[24]

53. Ibid., 1901. Ascites and œdema; suture, drainage. Sepsis and death in a few days.[24]

54. Ibid., 1901. Cirrhosis, ascites, umbilical hernia; suture. Died in six days from bronchopneumonia. (Operation for hernia also.)[24]

55. Fawcett, 1901. Ascites; suture, no drainage. Death in five days.[25]

56. Moullin, 1901. Ascites; suture. Death in four weeks, from pleurisy.[26]

57. Ibid., 1901. Ascites; suture. Death in one week from exhaustion.[26]

58. Ibid., 1901. Ascites; suture. Recovery, well two years later.[26]

59. Ibid., 1901. Ascites; suture. Recovery, well two years later.[26]

60. Ibid., 1901. Ascites; suture. Recovery, later condition not known.[26]

61. Doglioni, 1902. Renal disease, atrophic liver, enlarged spleen, ascites, œdema, three months duration; tapped once, intramural operation, no adhesions. Died in ten days of renal and liver toxæmia.[26]

62. Dubourg and Mongour, 1900. Enlarged liver, ascites, eight months duration; tapped thirty times, suture, no drainage. Recovery, no improvement. Died five months later.[19]

63. Ibid., 1900. Renal disease, atrophic liver, ascites, three months duration; tapped twice, intramural operation, no drainage. Died in three days of uræmia.[19]

64. Poggi and Tieschi, 1901. Atrophic liver, enlarged spleen, ascites, and œdema; tapped eight times, intramural operation. Died in five days of hemorrhage from stomach.[29]

65. Pascale (del Giudice), 1900. Atrophic liver, ascites; suture. Death in thirty days; no improvement.[28]

66. Pascale (Stigliano), 1901. "Grave case," malarial cirrhosis, ascites, atrophic liver, intramural operation. Recovery; no improvement.[35]

67. Pascale (Troncone), 1901. Ascites; intramural operation. Died in a few days.[35]

68. Pascale (Paolucci), 1901. Atrophic liver and ascites; intramural operation. Recovery; no improvement. Died in a few months.[35]

69. Pascale (Cardarelli), 1901. Ascites and œdema; intramural operation. Recovery; no improvement. Died after many days of toxæmia.[35]

70. Pascale (Paolucci), 1901. "Tuberculous" cirrhosis, liver atrophic, peritoneum thickened, ascites, two years duration; tapped every two weeks, intramural operation. Recovery; slight improvement one year after; was tapped fourteen times in first five months; not since.[35]

71. Pascale (Marciano), 1901. Ascites; intramural operation. Recovery; slight improvement three months later. Tapped twice after operation.[35]

72. Pascale (Stazio), 1901. Malarial cirrhosis, ascites, œdema; intramural operation. Recovery; slight improvement after several months.[35]

73. Pascale (Cardarelli), 1901. Ascites; intramural operation, adhesions. Recovery; improvement after fifteen days.[35]

74. Casati, 1901. Advanced cirrhosis, ascites; tapped many times, suture. Recovery; no improvement in thirty days.[34]

75. Lastaria, 1902. Cirrhosis, ascites; suture. Recovery; no improvement.[42]

76. Titovf, 1900. Cirrhosis, ascites; suture. Died in a few days from peritonitis.[12]

77. Ibid., 1900. Cirrhosis, ascites; suture. Recovery; no improvement. Died three months later.[12]

78. Peck (Brewer). Atrophic liver, ascites, enlarged spleen; suture, no adhesions, no drainage. Recovery; improvement five months later; tapped five times after operation; no return of ascites for two months.[38]

79. Markoe (Brewer). Atrophic liver, enlarged spleen, ascites; numerous taps, suture, no drainage. Recovery; no improvement.[38]

80. Ibid. Atrophic liver, enlarged spleen; suture. Recovery; no improvement.[38]

81. Kelly (Brewer). Atrophic liver, enlarged spleen, ascites, two years duration; tapped several times, suture, drainage. Recovery; improvement two years later; no ascites.[38]

82. Le Boutellier (Brewer). Enlarged liver and spleen, ascites, seven weeks duration; tapped twice; intramural operation, no drainage. Death in a few days from exhaustion.[38]

83. Syms (Brewer). Enlarged liver and spleen, ascites; tapped three times, intramural operation, no drainage. Death in seven days from uræmia.[26]

84. Ibid. Atrophic liver, enlarged spleen, ascites; intramural operation. Recovery; no improvement. Died in five weeks.[26]

85 Curtis (Brewer). Atrophic liver, enlarged spleen, ascites; intramural operation. Recovery; improvement; tapped after operation; no return of ascites.[26]

86. Ibid. Atrophic liver, enlarged spleen, ascites; numerous tappings, intramural operation, no drainage. Recovery; no improvement.[26]

87. Fisk (Brewer). Ascites, ten months duration; suture. Died in six days.[26]

88. Meyer (Brewer). Ascites; suture. Recovery; ascites did not recur. Died in four months.[26]

89. Ibid. Ascites; suture. Died in two weeks.[26]

90. Gerster (Brewer). Atrophic liver, ascites, severe hemorrhages; suture. Died in a few days.[26]

91. Lloyd (Brewer). Atrophic liver, enlarged spleen. Recovery; improved two years later.[26]

92. Tilton (Brewer). Atrophic liver, enlarged spleen, hernia, ascites. Died of shock. (Operation also on hernia.)[26]

93. Woolsey (Brewer). Ascites; not tapped. drainage. Death from peritonitis.[26]

94. Ibid. Ascites; tapped few times, drainage. Death from exhaustion.[26]

95. Ibid. Ascites; tapped few times, drainage. Death from exhaustion.[26]

96. Ibid. Ascites; tapped few times, drainage. Death from exhaustion.[26]

97. Ibid. Ascites; tapped twice, drainage. Recovery; improved; tapped less often.[26]

98. Ibid. Ascites; tapped twice, drainage. Recovery; improvement. Tapped less often.[26]

99. Bradford (Brewer). Enlarged liver, ascites; tapped eight times, suture, no drainage. Recovery; no improvement. Died in two and a half months.[26]

100. Burrell (Brewer). Atrophic liver, enlarged spleen, ascites; tapped many times, suture, no drainage. Recovery; no improvement. Died in a month.[26]

101. Greenough (not previously reported). Case from wards of Dr. F. C. Shattuck, Massachusetts General Hospital, 1900. Atrophic liver, enlarged spleen, ascites, twenty-one months duration; tapped twice, no œdema, suture, no adhesions, no drainage; no improvement. Died in three weeks.

102. Harrington and Vickery (not previously reported). Massachusetts General Hospital, 1901. Enlarged liver and spleen, ascites, œdema, four months duration; tapped three times, suture, adhesions, no drainage. Recovery; tapped four times after operation in forty-five days; improvement; no return nine months later. (To be published later in more detail.)

103. Koslowski, 1901. Cirrhosis, ascites; suture. Recovery; no improvement.[16]

104. Ibid., 1901. Cirrhosis, ascites; suture. Recovery; ascites did not recur.[16]

105. Villar, 1901. Cirrhosis; suture. Recovery; improvement.[21]

106. Ibid., 1901. Cirrhosis; suture. Recovery; improvement.[21].

107. Ibid., 1901. Cirrhosis; intramural operation. Recovery; no improvement.[21]

108. Ewart, 1899. Pericardial adhesions, enlarged liver, ascites, and œdema, five years duration; tapped fifty-two times, suture; peritonitis after operation. Recovery; no improvement. Died in one year; autopsy. (Reported as a case of mistaken diagnosis and similarity to Case 4 of Morrison's pointed out.)[9]

109. J. W. Elliot (case not previously reported, to appear in detail later). Enlarged liver, spleen normal, ascites, œdema, one year duration; tapped six times, suture, no drainage. Recovery; improvement. Six weeks later, tapped once after operation.

110. C. A. Porter and E. P. Joslin, Boston, 1900. Cirrhotic liver, enlarged spleen, ascites, no œdema, one and a half years duration; never tapped, intramural operation, no adhesions, drainage. Recovery; no improvement. Died. (Seven weeks phlebitis and embolus of lung, not previously reported.)

111. Mumford, Boston, 1898. Atrophic liver, ascites; suture, drainage. Recovery; no improvement. Died in three months. (Not previously reported.)

112. Kehr, Welp, 1902. Cirrhosis; suture. Recovery; improvement.[44]

113. Franke, 1902. Cirrhosis, ascites, suture. Died in seven days. Intestinal obstruction from pressure of colon on duodenum, operation, gastroenterostomy; death from pneumonia.[43]

114. Kümmell, 1902. Enlarged liver and spleen, ascites, and œdema; suture of ileus on fourth day; operation and death in few hours.[45]

115. Ibid., 1902. Extensive cirrhosis, enlarged spleen, and ascites; mitral stenosis; suture. Death in twenty-four hours.[45]

116. Ibid., 1902. Cirrhosis, ascites; tapped six times, suture. Recovery; ascites improved. Died in five weeks of myocarditis and pleurisy.[45]

117. Ibid., 1902. Enlarged liver and spleen, ascites, one year's duration; suture. Recovery improved one year later. Died of erysipelas.[45]

118. Ibid., 1902. Enlarged liver, ascites, jaundice; suture. Recovery; improved three months later.[45]

119. Ibid., 1902. Enlarged liver and spleen, ascites, long duration; suture. Recovery; improved in six weeks. (Heart lesion.)[45]

120. Bernays, Thompson, 1900. Alcoholic cirrhosis, ascites; Talma's operation. Recovery; no improvement. Died of the disease in six months.[37]

121. Ibid., 1900. Cirrhosis and ascites; operation. Recovery; improvement; time elapsed not stated.[37]

122. Lanphear, Thompson, 1900. Alcoholic cirrhosis, ascites; Talma's operation. Recovery; improvement; time elapsed not stated.[37]

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AUTOPSY IN A CASE OF ADIPOSIS DOLOROSA.

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The following case was presented *intra vitam* before the College of Physicians by one of us (F. X. D.), February 5, 1902. The history is briefly as follows:

Charles B., aged thirty-nine years, single; American by birth; wood carver by trade.

Family History. Father and mother living and well. Has four brothers and two sisters, who are in average health, except that one brother and one sister were for a time nervous.

Personal History. Had some of the diseases of childhood, but was in average health up to fifteen years ago, when he was acutely ill with some febrile affection which confined him to bed for over two weeks. He does not remember what the disease was, but merely that his "liver and kidneys were affected." Some time after this attack he began to grow stout. After a year or two had passed the fat began to accumulate in large masses upon the side of the chest, upon the abdomen, and other portions of the trunk. These masses were exquisitely painful to

the touch. About the same time masses of fatty tissue, painful to the touch, made their appearance about the arms and upper portions of the forearms. Smaller deposits of fat took place upon the thighs and also in the upper parts of the legs. Like the fat in other situations, it was very painful to pressure. Neither spontaneous pain nor crises of pain were present in any of the fatty masses. He noticed also that as the deposit of fat grew he became excessively weak and easily fatigued. Very slight exertion either in walking or in the use of his arms would fatigue him very readily. He observed also that his flesh would bruise very easily; that slight blows would bring about black-and-blue marks. Seven years ago, after a bruise of the left leg, he developed an ulcer which was a long time in healing; a similar ulcer also developed in consequence of a bruise on the opposite leg. The ulcers were always slow in healing.

Between four and five years ago he had an epileptic seizure. The attack was preceded by an aura, which began apparently in the abdomen and ascended toward the head. Unconsciousness was complete and the convulsion general. Three months later he suffered from a similar attack, and gradually the attacks became more frequent until they occurred once a month and more recently two or three in a week. He compares the aura to a sensation of nausea and vertigo. There was not at any time any vomiting. He frequently bit his tongue, and almost always passed his urine during the attack. In addition he frequently suffered from slight attacks which he says were not always attended by loss of consciousness. Frequently when the aura comes on he can, by rubbing his hands rapidly together, prevent the attack from maturing.

Some of the black-and-blue marks which make their appearance upon his body or limbs he cannot trace to injury. He says that sometimes he cannot account for them. He had at one time, about three years ago, also an attack of severe epistaxis, in which he lost so much blood that he was completely exhausted. He does not recall any other occasions when he suffered from any form of hemorrhage.

Status Præsens. The patient is a man very much below the normal stature, his height being only four feet ten and a half inches. He presents a striking appearance because of numerous accumulations of fatty tissue over the entire trunk. The abdomen is so pendulous that the genitals are concealed as though by an apron. Huge folds of the fat also hang from the sides of the trunk. The deposits of fat in the arms are not as great in proportion as the deposits of fat in the trunk. This is also true of the deposits of fat in the thighs and legs. Everywhere these masses of fat are exquisitely painful to pressure. All of the parts appear to be equally painful, save perhaps in the upper portion of the left side of the trunk and left shoulder, where the pain appears to be more pronounced than elsewhere. The skin is dry, but otherwise presents no abnormality.

The measurements of the trunk are as follows:

The circumference of the trunk at the axilla is 42½ inches; at the level of the nipples, 47½ inches; at the umbilicus, 51¾ inches; and below the umbilicus, 57 inches. The right arm measures in its upper third 16 inches; in the middle third, 14½ inches; while the upper portion of the forearm measures 9¾ inches. The left arm measures at the upper third 15¾ inches; in the middle third, 12¾ inches; and the upper

portion of the forearm measures 9 inches. The circumference of the neck is 15 inches. The right thigh measures in the upper third 23 inches; in the middle third, 17¼ inches; and in the upper third of the right leg, 14½ inches. The left thigh measures 23½ inches in its upper third; in the middle third, 16½ inches; and in the upper third of the left leg, 14¾ inches. Weight, 206 pounds.

FIG. 1.

FIG. 2.

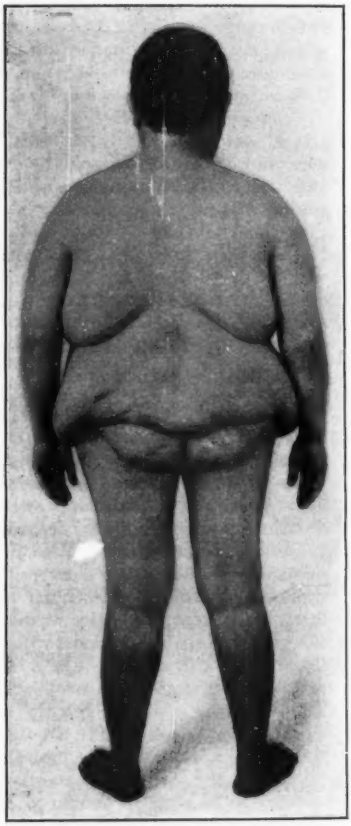


FIG. 1.—Shows the peculiar apron of fat. The small size of the hands is shown here.
FIG. 2.—Posterior view shows the arrangement of fat in folds over the hips.

It is a noteworthy fact that the lower portions of the forearms and hands and the lower portions of the legs and feet are entirely free from all fatty deposit, the skin being here, indeed, so fine in texture that the tendons can be very readily discerned beneath it.

There is some fatty deposit in the face, though this is much less in proportion than that which is observed in other portions of the body. There is also a dependent fold of fat beneath the chin. The face is somewhat flushed, with a tendency to lividity. Irregular flushing, with here and there tendency to lividity, is also observed over various parts of the body. Here and there also the veins are somewhat prominent.

Extensive scarring, due to leg ulcers, one of them still incompletely healed, are present in the legs.

The knee-jerks are normal. There is no ankle clonus. There are no areas of anæsthesia or hyperæsthesia. The viscera, as far as it is possible to examine them, are normal. The urine also reveals no abnormalities.

An examination of the eyes was made by Dr. C. A. Veasey, with the following result:

There is a very slight ptosis of the left side and some weakness of the internal rectus. The appearance of the conjunctiva is very interesting. In front of the equator of the eyeball it is so translucent that the muscle fibres and the tendinous insertions of the various muscles can be distinctly seen. Back of the equator of the eyeball the conjunctiva assumes a thickened, yellowish appearance, as if due to deposits of fat beneath. There are accumulations of fat in the orbital cavity which can be distinctly felt by the fingers. The reaction of the pupils to light is normal. The reaction to accommodation and convergence is present, but very sluggish; and if either eye be tested separately, the other eye being covered, there is a very moderate *dilatation* of the pupil in accommodation and convergence instead of contraction. This result was obtained by repeated tests and confirmed by the observation of those standing by. The fundus changes are those of very high myopia. With his glasses, the vision of the right eye equalled 6/12 and of the left 6/15. Both eyeballs are quite prominent. The media were hazy on account of many vitreous opacities.

Within one week after the presentation the patient was attacked by erysipelas. The erysipelas was diffuse, spread rapidly over the body, and the patient succumbed in a few days. Autopsy was held twenty-four hours after death.

Autopsy. The body is that of a male of medium height, with tremendous deposits of fat over the trunk and extremities, hanging in folds about the abdomen and hips. The skin over the face and neck and over the right side of the trunk is reddened and covered with small miliary vesicles. The testicles are undeveloped, the penis is small, and there is a very scanty growth of hair on the pubis.

On opening the abdomen the superficial fat of the abdominal walls measures 3¾ inches in thickness. In the line of the incision—*i. e.*, from the xiphoid to the pubis—four nodular areas of congested appearance are seen. The largest of these is the size of an orange, easily separated from the surrounding fat, and inclosed in a membranous capsule of connective tissue. Over the surface of this mass of fat several small nerve fibres can be seen. On section, the fat in these capsules is firmer than the free fat surrounding it, is of a reddish color, and contains considerable blood. (See Fig. 3.)

Lying loose in the yellow fat, several small, firm bodies, the size of a split pea and of a yellowish-brown color, were found. These proved on microscopic examination to be hæmolymph glands.

On opening the abdomen the omentum was found thickened to three-quarters of an inch by a deposit of a pale yellow fat. The intestines were also surrounded by large masses of fat, and it was very difficult to locate the kidneys or suprarenal glands on account of the excessive fatty deposits. The appendix was normal. The gastro-intestinal tract was normal. The kidneys were swollen; the capsule stripped easily; on section they were bloody, the cortex swollen and injected, and the glomeruli very prominent. The right suprarenal gland was about twice the normal size; it showed no abnormality on section. The left suprarenal could not be found on account of the fat. The bladder was empty and normal. The ureters were not abnormal. The liver

FIG. 3.

A fatty nodule dissected from the subcutaneous fat, shows the encapsulation of the fat, with nerve fibres branching over it.

showed a very marked degree of fatty infiltration, but was otherwise normal. The spleen was of normal size and firmer in consistence than the normal organ.

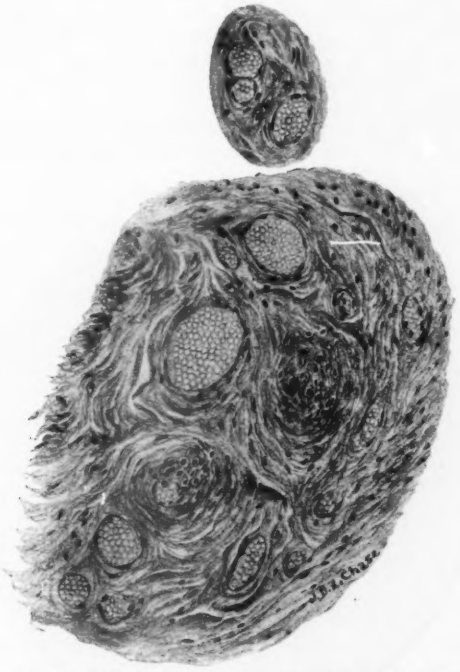
The pericardium contained about one-half fluidounce of fluid; otherwise normal. The heart was surrounded by a thick layer of fat. The valves were normal. The heart muscle was soft and fatty. The lungs were normal.

There was no enlargement of the thymus. The thyroid glands were of normal size, but of firmer consistence than is usually met with.

The brain: The calvarium was of medium thickness; the dura was firmly adherent. The pia and brain did not present anything abnormal other than a slight subpial œdema. In attempting to take out the pituitary body it was necessary to remove the sella turcica. This was easily done, because the bone was so soft that it was easily cut with the ordinary dissecting knife without effort.

The gross examination of the brain revealed a very interesting arrangement of the convolutions in the prefrontal lobe of the left side. The first and second frontal gyri followed the normal type. The posterior third of the third frontal corresponding to Broca's convolution showed a very remarkable development. Instead of the simple fold of the third frontal around the short limb of the fissure of Sylvius, a triple fold, arranged very much after the shape of a three-leaf clover, is seen. From the middle one of these folds a broad gyrus curves upward into the area occupied usually by the second frontal. The

FIG. 4.



Section of nerve in diseased subcutaneous fat nodule, showing interstitial neuritis. A distinct overgrowth of connective tissue is present between the nerve fibres. The number of bloodvessels is also increased over normal nerve tissue.

fissure of Rolando at its median end divides into three fissures. The posterior boundary of the ascending parietal convolution is formed by a deep fissure which extends from the fissure of Sylvius to the superior longitudinal fissure. An abnormal fissure corresponding to the interparietal fissure begins one-half inch behind this fissure and extends to the occipital lobe. The angular gyrus is more complex than is usually met with, and is formed by three folds of irregular shape. An external perpendicular fissure and deep Wernicke fissures are also present in the occipital lobe. The right hemisphere also shows a com-

plex arrangement of the convolutions. The first and second frontal begins at the anterior end of the brain as a single gyrus, and then divides into two distinct, nearly straight gyri of ample volume. The third frontal shows the same arrangement, although the gyri are not so large as that of the left hemisphere. The superior parietal lobe is divided by two nearly transverse fissures.

The microscopic examination of the brain and the upper cervical region of the spinal cord by the Weigert sheath stain, Marchi, carmine, Nissl, and nuclear stains revealed a perfectly normal structure.

The sciatic and ulnar nerves were likewise perfectly normal.

The peripheral filaments of nerves in the nodules of subcutaneous fat showed a marked distention of the capillary vessels of the larger nerve filaments. The nerve fibres were few in number and surrounded by large numbers of connective-tissue nuclei and fibres. No such changes could be found in the intramuscular nerve fibres. (See Fig. 4.)

The muscle tissue was normal.

Microscopic examination of the subcutaneous fatty nodules: Each of the larger nodules was composed of capsules inclosing large numbers

FIG. 5.

Section of the interior of a fat nodule showing hæmolymphoid tissue. The bloodvessels are seen in the lower half of the picture; the reticular tissue and round-cell formation in the middle and upper portion of the section.

of small, oval, fatty bodies connected with each other and with the capsule by delicate fibrous bands. These delicate trabecula united and joined thick, jelly-like bands attached to the capsule. Sections made through the connective-tissue capsule and the fatty bodies *in situ* gave the following structure: The capsule was composed of several layers of well-developed connective tissue. Within this capsule a looser

areolar tissue is met. This tissue is highly vascular, and between the vessels is a reticular tissue, denser in some areas than others, and inclosing a large number of mononuclear cells, a few polynuclear cells, and large numbers of cells staining a tawny color by the Van Gieson stain. Scattered through the granular, tawny masses many of the mononuclear type of cells may be found. In other areas granules of blood pigment in clumps may be seen. Wherever the connective-tissue trabeculæ penetrate into the congested fat nodule, this same fine, reticular structure, holding in its meshes rich plexuses of bloodvessels, and between these a fine reticulum of connective tissue filled with a light yellow granular material, with nucleated yellow cells, small mononuclear cells, polynuclear cells, and numbers of degenerating red blood cells, may be seen. Some of these cells react to many of the staining reagents as do nucleated red blood corpuscles, but to the Biondi-Ehrlich triple stain they appear more as mononuclear leucocytes. This tissue is identical in structure with the hæmolymph glands found in the immediate neighborhood of the large, congested nodules of subcutaneous fat. (See Fig. 5.)

The chemistry of the free subcutaneous fat, the fat in the congested subcutaneous nodes, and the mesenteric fat was investigated by Dr. D. L. Edsall, who sent the following report:

"Portions of the tumor masses, of the subcutaneous fat, and of the omental fat were ground in a mill, warmed to almost 60 per cent. on the water-bath, and strained through a cloth. The iodine value, the melting point, and the acid value of each was determined.

"The iodine value was as follows: tumor fat, 71.53; subcutaneous free fat, 70.03; omental fat, 69.18. All these figures are about the same as those previously determined for human fat—*i. e.*, 70.

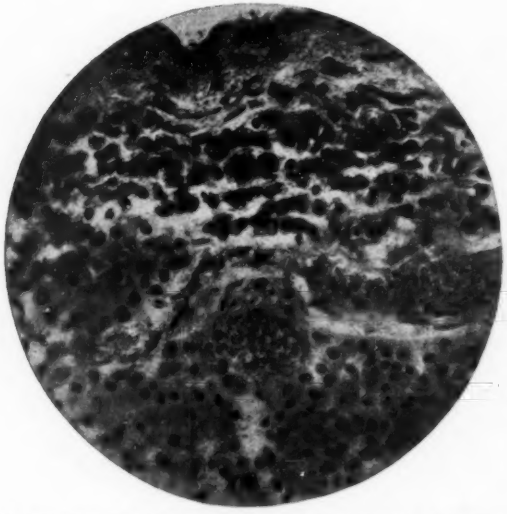
"The melting points were: tumor, 28.5° C.; free fat, 29° C.; omental fat, 31.5° C.

"The acid values per 5 grammes of fat were as follows: nodules, 4.4; free fat, 2; omental, 1.2—in each case the figures indicating the amount of decinormal sodium hydrate solution necessary to neutralize. The determination of the acid values was of special interest, as a marked increase in the free acidity would have indicated that this was connected with the pain and tenderness and perhaps with the other symptoms. The figures are, however, all rather low, and those for the tumor fat lowest of all, and decidedly below those previously found in normal fat. This is a fact of considerable interest, but the value of which is not evident. The amount of fat at my disposal was not sufficient for more elaborate investigation, and no valuable results were likely to be obtained from the determination of other factors."

The pituitary body was closely adherent to the dural lining of the sella turcica, and an attempt at removal of the gland revealed a calcareous layer material, from 1 to 3 millimetres in thickness, between the dura and the gland substance. When this was removed, what appeared to be the normal portion of the gland occupied the left quarter of the mass; the remaining three-fourths consisted of a tumor mass. It was of the same consistence as the gland structure, roughened on the surface where the calcareous plate had been removed, and attached at its farthest end to the internal carotid artery.

Microscopic Examination. The calcareous plate under the microscope showed a true bone reticulum infiltrated with the eosinophilic cells comprising the tumor mass. Sections were made transversely through the gland and tumor. The tumor mass was composed almost entirely of the eosinophilic type of cells, arranged irregularly, with a minimal amount of interstitial tissue. Around the periphery of the tumor mass the cells were arranged in parallel rows, much after the type of cell arrangement seen in endotheliomata. The tumor mass had, on account of the arrangement of the cells in rows at its periphery, an appearance as if it were encapsulated and separated from the normal gland tissue. A careful study of the cells of the tumor revealed no trace of a regular arrangement of the cells, such as is seen in the acini of the

FIG. 6.



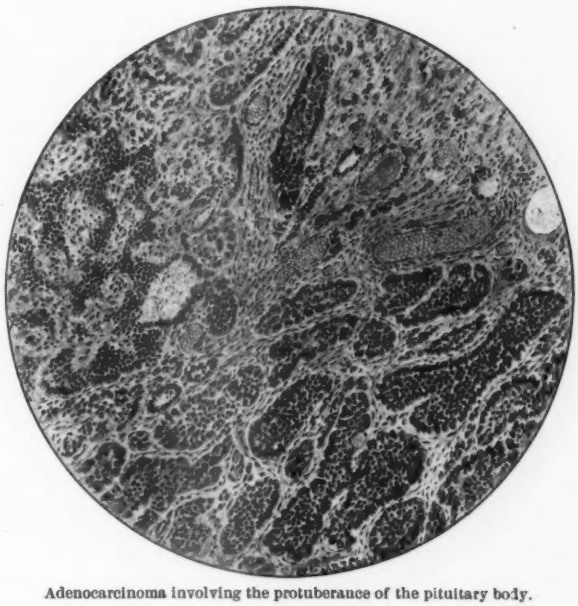
Tumor of the glandular portion of the pituitary body. The capsule of the tumor, consisting of rows of cells arranged like an endothelioma, is seen at the top of the section. The body of the tumor, consisting of the eosinophilic type of cell, is seen in the lower half of the section.

normal gland. The individual cells were round, stained a pinkish-red with eosin, and contained a small, deeply staining nucleus. The nucleus in some of the larger cells was very large and irregular in shape, such as is frequently seen in proliferating cells. The cells varied greatly in size; some were twice the size of the normal gland cells, others one-third to one-fourth that size. Between these cells, and at times in the capillary vessels of the tumor mass, small areas of colloid material were seen. (See Fig. 6.)

The area of normal gland tissue—*i. e.*, arranged according to the normal gland structure—is about one-third the size of the normal adult gland, and is situated between the tumor mass and the protuberance, consisting of cerebral tissue. The larger portion of the glandular

acini are perfectly normal. At the junction of the latter with the nerve tissue, and extending into the latter area, are large groups of cells, following an alveolar arrangement and differing from the rest of the section by the deep staining properties of the cells with nuclear stains. The posterior portion of the gland, composed of reticular nerve tissue, is permeated by the small, round, deeply staining nuclei in such a way as to give the impression that the infiltrating process followed definite lymph channels. At the periphery of the acinous portion of the gland, masses of colloid material, of sufficient size to be visible to the naked eye as minute dots, are inclosed in areas lined by rounded cells. The tumor mass, composed as it is of the same type of cells as make up the acinous portion of the gland, must neces-

FIG. 7.



Adenocarcinoma involving the protuberance of the pituitary body.

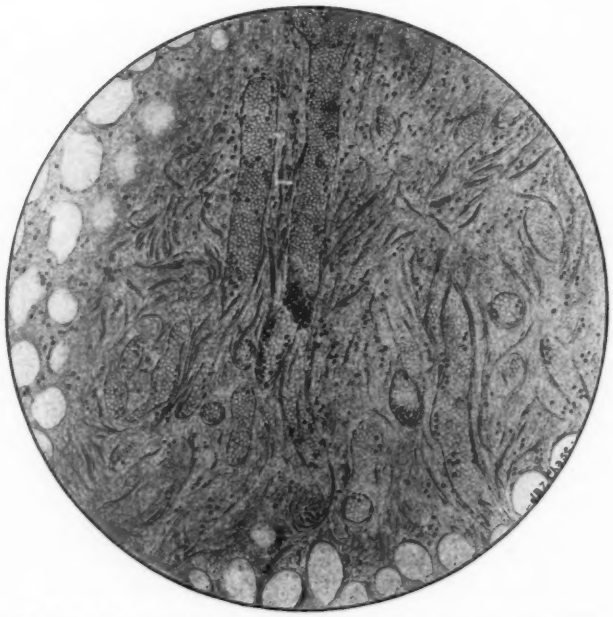
sarily belong to the carcinomata. (See Fig. 7.) The infiltrating tumor formation beginning in the acinous portion of the gland and involving the cerebral portion of the gland follows the cell arrangement of an adenocarcinoma. The arrangement of the eosinophile cells of the tumor mass around the periphery of the tumor resembles an endothelioma, but the type of cell points strongly to a diagnosis of carcinoma.

The presence of colloid matter in the small vessels of the tumor mass and between the cells of the tumor points strongly to the theory that cells of a tumor derived from a functionating tissue, such as the pituitary glandular structure, may still, even under such a pathological condition, carry on to a limited extent the function of the mother tissue. The presence of the acromegalic group of symptoms in some tumors of

the pituitary and its absence in others may be explained by such a condition as obtains in this case.

The small ovoid bodies, above referred to as hæmolymph glands, found in the subcutaneous fat, were composed of a capsule of connective tissue, from which trabeculæ of connective tissue spread in many different directions throughout the body. Within this trabecular network a rich plexus of capillaries was found. Between the capillaries the fine meshwork of fibres contains large numbers of lymphoid cells, with here and there groups of red blood corpuscles. Free blood pigment giving the iron reaction was found in small quantities free in the trabecular network. The opinion of Dr. Simon Flexner that these

FIG. 8.



Section showing the peripheral portion of a hæmolymph gland. The bloodvessels, reticular tissue, and round-cell formation are seen.

structures were new-formed hæmolymph glands was confirmed by that of Dr. A. S. Warthin, of Ann Arbor, who has recently written on the subject. (See Fig. 8.)

Spleen. The microscopic examination of the spleen showed hyperplasia of the connective-tissue elements and a very curious formation of capillary vessels throughout the spleen, which amounts in some places to an angiomatous formation.

Thyroid. A careful study of the thyroid by Dr. Flexner revealed a perfectly normal structure.

Testicles. The testicles were undeveloped and showed no evidence of functional activity, but were otherwise normal.

Kidneys. There are present all the histological changes of an acute parenchymatous nephritis. Free blood was present in the glomeruli, within and between the tubules, with cloudy swelling and degeneration of the tubular epithelium.

Adrenal. The adrenal removed was twice the size of the normal gland, but was perfectly normal under the microscope.

Liver. This organ presented the usual microscopic picture of a high degree of fatty infiltration.

The heart and lungs were normal.

A résumé of the pathological findings may be given as follows: Adenocarcinoma of the pituitary body; anomalous arrangement of the cerebral convolutions; excessive fissuration and confluence of fissures; fibroid hæmolymphoid nodules in the subcutaneous fat, in a state of acute congestion; interstitial neuritis of the nerve filaments of the superficial fat; newly formed hæmolymph glands in the subcutaneous fat; telangiectatic angioma, with slight interstitial hyperplasia of the spleen; defective development of the testicles; acute parenchymatous nephritis; cutaneous erysipelas.

The above is the fifth case of adiposis dolorosa which has come to autopsy. In the first two cases placed on record by one of us (F. X. D.) gross disease of the thyroid gland was noted macroscopically, the gland in both instances being enlarged and the seat of calcareous infiltration. Unfortunately, the specimens in both of these cases were lost and could not be examined microscopically. The third autopsy was likewise reported by one of us (F. X. D.), and was the first in which a microscopic examination was made. It revealed, as prominent features, irregular atrophy of the thyroid gland, with here and there efforts at compensatory hypertrophy; also extensive interstitial neuritis in various nerves as they passed through the fatty tissue, and, in addition, degeneration in the columns of Goll. In the fourth case—that reported by Dr. Burr—there were present in the thyroid gland changes identical with those above described, interstitial inflammation of nerves, and, in addition, enlargement and gliomatous degeneration of the pituitary body. The ovaries were small and atrophic.

In the present case changes in the thyroid gland are very slight. The changes in the pituitary body, as already stated, are those of enlargement, with new formation. An interstitial neuritis is also present. The significance of the presence of hæmolymph glands is probably that of a profound disturbance of nutrition, due, it may be, to disease of the thyroid and pituitary glands. They are probably to be regarded as efforts at compensation and probably having a compensatory function. It is exceedingly remarkable that hæmolymph glands should exist, as this is the first instance, we believe, in which they have ever been found in man as new-formed structures.

Just what is the rôle of the thyroid gland in this disease is problematical. The cases reported by Dercum and Burr would lend color to the assumption that the changes in the thyroid gland, being atrophic in character, are related to the excessive production of fat. In the present case, however, changes in the thyroid gland, though present, are not pronounced. The changes in the pituitary body, on the other hand, are very marked; and, bearing in mind the interrelation which exists between the thyroid gland and the pituitary body, the changes in the latter are, to say the least, very significant. The pituitary body is thus brought into relation, though perhaps indirectly, with a fat-producing or fat-destroying function—a relation which, up to this time, has not been considered. The fact that the thyroid gland has been found diseased in every one of the five cases coming to autopsy cannot but be of significance.

Thus far about twenty-eight cases of adiposis dolorosa have been reported. Both the clinical findings and the results of the autopsies establish the fact that adiposis dolorosa is a well-defined clinical entity. The remarkable character of the post-mortem findings should stimulate pathological studies in simple adiposis.

DIPHTHERIA WITH PERSISTENT TRISMUS AND OPISTHOTONOS. ESCHERICH'S PSEUDOTETANUS.*

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In 1897[1] Escherich described a curious symptom-complex, consisting of persistent generalized tonic contractures of the muscles of the jaw, neck, back, and legs. To this condition he gave the name of pseudotetanus, classifying it as a rare type of tetany. This pseudotetanus in its clinical history bears much resemblance to true tetanus, having in common the symptoms of trismus, opisthotonos, muscular crises, and laryngospasm. It may occur as an independent malady or associate itself with an acute infectious process, as diphtheria, scarlatina, grippe, otitis media. Nearly all of the recorded cases have at first been diagnosed as tetanus. Nevertheless, although the onset of the disease is acute, it quickly assumes a more tranquil type; and although the same group of muscles may be affected in false and true tetanus, the course and termination of the diseases are widely different. It is quite probable that many cases of so-called idiopathic tetanus ending in recovery are merely examples of this interesting phase of tetany.

* Read at the Boston session of the American Pediatric Society, 1902.

No writer upon tetany has a wider experience or greater knowledge than Escherich, of Gratz. His material, amounting to hundreds of cases, has been carefully analyzed, and a masterly treatise upon tetany was read by him in Moscow in 1897. He states that tetany is a condition with a free sensorium, no fever, and consists of tonic contracture of groups of muscles; that it is independent of rhachitis; that laryngismus is a tetany of the laryngeal muscles often associated with other signs of tetany.

Two forms of the disease are seen: (1) Intermittent muscular contractures; (2) persistent muscular contractures.

The intermittent form, observed usually in rhachitic children, is characterized by short, painful cramps, heightened mechanical and electrical excitability, and acute or subacute course, with a tendency to recurrence. Trousseau and Chvostek's signs are easily elicted. On the contrary, in what Escherich calls the persistent or tranquil type the contractures affect the trunk or extremities, run a painless and chronic course, continuing even in sleep for weeks or months. The especial nerve excitability—Trousseau, Chvostek, Erb's symptoms—may be lacking. The persistent contractures may involve single muscles, be localized in the extremities, may affect the entire body, may occur by themselves, or as a complication of various affections. When the tonic muscular spasm involves principally the masseters and dorsal muscles Escherich gives to that condition the name of pseudotetanus.

The onset of pseudotetanus is usually abrupt. A child either previously well or suffering from some acute infection or toxæmia is attacked with stiffness in the legs and rigidity of the jaws; the contracture rapidly extends until the patient lies helpless in bed with trismus, opisthotonos, and rigidity of the extremities. The arms may be spared or very lightly affected; the muscular crises (acute muscular spasms) are usually mild and few in number as compared with tetanus. The classical signs of tetany—Trousseau and the facial symptoms—may not be present. The malady lasts from one to six weeks, the patient comfortable, even cheerful, in his unnatural posture. All of the cases of pseudotetanus reported, in spite of threatening laryngismus and intercurrent disease, made complete recoveries.

In Allbutt's[3] *System of Medicine*, Rissen Russell, writing of tetany, mentions gradations in muscular contracture from carpopedal spasms to those simulating tetanus. He states that the poison of tetany acts upon the neurons of the medulla and anterior horns of the spinal cord, damaging their function and nutrition; that all neurons are not equally affected; that in different cases varying groups of muscles may be involved, and that in some cases a wide implication of nerve cells may exist, extending even to the motor neurons of the cerebral hemispheres. Russell says the masseter, cervical, and dorsal muscles may be attacked,

producing trismus, and opisthotonos suggestive of tetanus, but differing from that disease in the happy issue of the malady.

Escherich has described a pseudotetanus of the newly born, with opisthotonos and recurring arrest of breathing. Of this type I reported two cases in the *Archives of Pediatrics*, October, 1901, under the title of "Acute Recurring Respiratory Failure in the Newly Born."

My interest in pseudotetany was awakened by attending a mild case of diphtheria associated for many days with the very singular complications of trismus, opisthotonos, spasms of the muscles of the extremities, and laryngismus. This condition, which I at first called tetanus, I shall now classify as Escherich pseudotetanus.

St. Ange Roger[3] in his *Thèse de Paris*, 1902, on "Rare Forms of Infantile Tetany," has collected nine cases of pseudotetanus in children. Of the ten cases—St. Ange Roger's and my own—nine were boys, one a girl. The ages varied from four and a half to nine and a half years. All of the children had the symptoms of trismus opisthotonos—tonic spasms of the legs—and all recovered.

In four cases the disease existed by itself, two were complicated by diphtheria, one by influenza, one scarlatina, one intestinal worms, one by otitis media and rhinitis. In two cases the facialis and Trousseau symptoms were present, one absent, and one not mentioned.

My patient was a Polish boy, aged seven years, of strong, vigorous physique. About August 25, 1901, it was stated that he ran a sliver of wood into the sole of his right foot. This accident was afterward denied, and no injury was found in his foot at any time. August 31st the boy complained of sore-throat, and was seen by the family physician. The doctor discovered a diphtheritic tonsillitis and pronounced rigidity of the spine; a day later the jaws grew stiff, and the child was unable to open his mouth. The muscular contracture which was first observed in the back, then in the masseters, lastly invaded the extremities, the legs became extremely rigid, and the arms slightly so. On the sixth day of the disease there appeared frequent attacks of laryngismus. The boy would cease breathing, grow black in the face; the arms and legs would stiffen out, and the trunk would arch backward, so that the patient touched the bed only with his occiput and heels. These muscular crises were frequent and severe, so that on the sixth and seventh days of illness the physician in attendance counted four in one-half hour. The muscular contractures were painful, and were often caused by handling or efforts at treatment. Thus after a week's illness, in addition to the tonsillar diphtheria, there had developed violent generalized tonic muscular spasm of the jaws, neck, trunk, extremities, and respiratory tract. No fever. Tetanus was diagnosed, and the boy entered the Buffalo General Hospital September 7th.

The resident physician, Dr. Leonard, gave chloroform to relax the jaws, and examined the throat. He perceived a diphtheritic exudate on the tongue, tonsils, cheeks, and roof of the mouth. The tongue was enormously swollen and bulging between the teeth; its tip was literally hanging in shreds, evidently lacerated by the teeth in a spas-

modic closure of the jaws. There was a purulent nasal discharge and swollen submaxillary glands; cultures from the nasal discharge, tongue, and throat showed the diphtheria bacillus. Diphtheritic antitoxin was administered; a slight amount of fever present disappeared, and the pulse and temperature remained normal throughout the disease. After the chloroform narcosis had passed away the trismus and opisthotonos rigidity of the extremities returned. Violent muscular tetanic paroxysms, with opisthotonos and cyanosis, occurred in the morning and afternoon of September 9, 5.30 A.M. September 10, and 3.30 A.M. September 11, when these symptoms finally disappeared, and he passed into the tranquil type mentioned by Escherich.

I first saw the patient September 11th. He was well nourished; clear mentality; fairly comfortable in mind and body. He lay upon the abdomen, with the head slightly retracted, but easily movable; no ocular symptoms, jaws tightly closed, masseters hard and firmly contracted; the face wore the grin of lockjaw. Several teeth gone; tongue swollen, lacerated, and dotted with patches of grayish exudate; respiration normal; swallowing easy. The boy, although very hungry, was fed through a tube between the teeth. He at times made heroic but futile attempts to open his mouth and masticate solids. The opisthotonos was pronounced; the abdominal muscles were as hard as a board. In the arms and hands there were at times slight contractures; the thigh and leg muscles firmly contracted. By gentle manipulation, flexion, extension, and rotation of the legs could be executed; sensibility everywhere increased; knee-jerks active; Kernig's sign absent. Trousseau sign absent; facialis sign impossible to elicit on account of the contracture of the face. The contractures in the extremities varied, sometimes almost completely disappearing; the masseters were always rigid; the teeth could never be separated more than one-sixteenth of an inch; the arching of the back would slightly increase or diminish, but never disappeared, day or night. The child was not nervous or emotional, but only rough handling could accentuate the contractures. His voice was natural; urination and defecation in order; maculopapular rash present on trunk and extremities.

The idea of tetanus being paramount, ten doses of tetanus antitoxin were given September 12 to 21st. This treatment made the boy very restless, and had absolutely no effect upon the muscular rigidity.

From September 12 to 21st the child lay in the condition I have described—persistent trismus and opisthotonos and intermittent contractures of the extremities. The diphtheritic infection, proved by six positive cultures, caused no fever, prostration, or appreciable disturbance of the health.

September 21st the tetanus antitoxin was discontinued, and morphine, $\frac{1}{32}$ of a grain, was given hypodermically. A very comfortable night was the result, and, for the first time in three weeks, the opisthotonos disappeared, and the tight contracture of the masseters had somewhat relaxed. At my next visit the child was lying easily on his back, and could separate his teeth about one-quarter of an inch.

From September 21st to 27th the morphine, $\frac{1}{32}$ of a grain, was given every three hours, and the improvement was continuous. The patient slept on his back, with the muscles of the trunk and legs relaxed.

During the day there was slight arching of the back and contrac-

ture of the thigh muscles. The trismus was still present, but each day the jaws could be more widely opened.

September 24th to 27th the teeth could be separated one-half inch; there was still rigidity of the thigh and abdominal muscle; the back was normal.

27*th*. The patient sat up for the first time, and opened his mouth in a natural manner.

30*th*. The boy was able to walk and eat solids. From this date he rapidly improved, and was soon discharged from the hospital, with all muscular functions in order.

I have described a mild diphtheria associated with prolonged contracture of the masseter and dorsal muscles. From the third to the tenth day of illness, laryngismus and violent generalized muscular spasms occurred; after the tenth day the disease assumed a tranquil type, with persistent trismus and opisthotonos.

These contractures lasted twenty-one days, unaffected by tetanus antitoxin, but eventually relieved by morphine.

Trismus, opisthotonos, and muscular crises are symptoms absolutely foreign to diphtheria, and undoubtedly indicate the coexistence of another disease. The clinical picture would suggest tetanus of a most benign character. Tetanus is apt to be the result of an infected wound. The muscular crises and laryngospasms are increasingly severe, and usually end in death; while tetany is often allied with other maladies, and the motor symptoms are rather those of tonic contracture than recurring spasms.

The mixed infection of tetanus and diphtheria does not make the diphtheria milder, as was proven by the St. Louis epidemic of tetanus, in which horses immunized by diphtheria toxin afterward developed tetanus. Ten children given serum from these horses as a remedy against diphtheria, died of tetanus. The absence of Trousseau's and Chvostek's signs in my cases does not necessarily exclude tetany, as Escherich declares that in the type of tetany with persistent contractures these symptoms are seldom found, although similar groups of muscles are affected in true and false tetanus. The long-continued contracture of the jaw and dorsal muscles existing in a condition not dangerous to the patient is most suggestive of Escherich's pseudo, tetanus.

In concluding I would present some illustrative cases of pseudo-tetanus reported by Escherich and St. Ange Roger.

In three cases of Escherich's[4] the disease occurred in three boys, aged six, nine, and nine and a half years. The symptoms and course of the malady agreed in all the details. The children were previously healthy, with no hereditary taint, with no exciting cause; they first complained of stiffness in the legs, which hindered them from walking and compelled them to take to their beds. The rigidity rapidly spread

upward and attacked the muscles of the back and jaw, so that the boys lay in an extended position, motionless and stiff as a board. The muscles of the entire trunk, neck, and legs were powerfully contracted; the rigid masseters gave the patients the grin of lockjaw. If the children were asleep or quiet the contractures lessened, but never disappeared; on the contrary, noises, handling, cold, or psychical emotion caused violent muscular crises, with opisthotonos and laryngismus. At the height of the disease these respiratory and muscular spasms came on spontaneously several times a day, and were followed by profuse perspiration. In striking contrast to the woodeny appearance of the body, the arms, hands, and eye muscles remained freely movable. The disease increased in severity for a few days, remained stationary from three to six weeks, and then the contractures gradually lessened, and the boys, after considerable persuasion, were induced to use their legs again. After commencing to walk some stiffness remained for two to four weeks. Trousseau's and Erb's symptoms were absent. Escherich at first diagnosed hysteria, then idiopathic tetanus, finally deciding that the symptoms were a phase of tetany.

Baginsky[5] reports a case of tetanoid symptoms with diphtheria. The patient was a boy, aged four years and nine months. He complained of pain on chewing food, and was received into the hospital with characteristic trismus. Any efforts to open the mouth caused general convulsions, with arrest of breathing. On the edge of the tongue was a deep ulcer, covered with a grayish exudate. Considering the case one of lockjaw, Dr. Behring administered the newly discovered tetanus antitoxin for three days; no immediate effect was observed from the treatment, but the tetanic symptoms diminished in severity and disappeared in twelve days. The child afterward developed a suppurative arthritis, scarlet fever, diphtheritic ophthalmia, and diphtheritic paralysis; virulent diphtheria germs were found on the tongue, and the child infected two wards with diphtheria. No tetanus bacilli were found in the pus from the joints. The patient passed through this long series of illnesses in safety.

Question. Was there a double infection of diphtheria and traumatic tetanus from a wound in the tongue, or were the tetanoid symptoms a rare complication of diphtheria?

Behring held that a double infection existed, and ascribed the muscular contractures and crises to tetanus.

Baginsky attributed the trismus and opisthotonos to a nervous complication of diphtheria, due to the proteus bacillus. Escherich called the condition pseudotetanus. Henoch declared he had never seen a similar case.

Guinon[6] reports a case of a boy, aged four and a half years, who was suddenly attacked with trismus, opisthotonos, and muscular spasms of

the leg lasting thirteen days and subsiding with the appearance of a discharge from the ear.

Gomez[7] reports a case of a boy with grippe, complicated with trismus and painful contractures of the arms and legs, so that he lay helpless in bed. Chvostek's and Erb's signs were present. The patient was relieved by saline infusions, although the contractures lasted a month.

Guinon[8] reports a case of a boy, aged four and a half years, who in the course of scarlatina was taken with stiffness of the legs, trismus, and contractures of the extremities. Trousseau and the facialis symptoms were present. There were recurring muscular crises, with pronounced opisthotonos. The tonic muscular spasms were severe for eleven days, and had not entirely disappeared until the end of a month.

Cesare Cataneo[9] records a case of pseudotetanus in a boy, the symptoms subsiding abruptly after the evacuation of large quantities of lumbricoid worms. The child was of nervous heredity, good physique, save that he occasionally passed round worms. On May 2d, while taking a walk, he fell down, as stiff as a board, with the jaws tightly set. He was carried to the hospital, where the following conditions were noted: pronounced trismus, arms slightly contracted, legs rigid, pain in the back, recurring opisthotonos, frequent respiration, no fever.

The case was diagnosed as tetanus. Injections of carbolic acid were given. The trismus, opisthotonos, rigid leg muscles, and rapid respiration continued for eight days. The intelligence was clear, noise augmenting the muscular spasms. On the eighth day the boy was no better, and at the request of the father a large dose of castor-oil was given. A number of large, fetid stools containing masses of lumbricoid and pin worms was the result. The trismus and opisthotonos immediately disappeared, and were obviously due to tetany caused by intestinal toxæmia. A long, serious attack of bronchopneumonia followed. There was no recurrence of the tetany, and the child ultimately recovered.

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TUBERCULOSIS OF THE PAROTID GLAND; EXCISION OF THE TUMOR; RECOVERY. NO RECURRENCE ONE YEAR AND MORE AFTER THE OPERATION.

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of Boston,
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A. M., aged fifty-seven years; *Massachusetts General Hospital Record*, vol. xxxvii., p. 248; service of Dr. A. T. Cabot.

Family History. Negative.

Personal History. Always well; married twenty-six years; has three children.

Present Illness. Five years ago a small swelling appeared just below the lobule of the right ear. Three years it grew slowly. For over

Fig. 1.

Note line of incision used in removal of tumor of parotid.

a year it increased perceptibly, but painlessly. She has had no subjective symptoms. Her hearing is good. There have been no pressure disturbances.

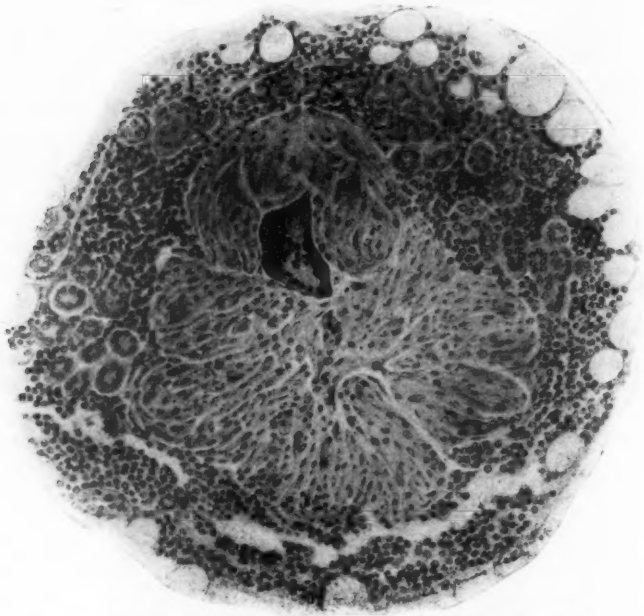
Physical Examination. A large, fleshy, and well-developed woman. In front of and below the right ear is a broad, spherical swelling, about two inches in diameter. It is hard and rounded, with irregular, indurated borders. It is slightly movable upon the parts beneath. It is not attached to the skin, nor is it tender to palpation. The chest is negative.

Operation. Mass removed through a curved incision. Capsule adherent closely to the surrounding parts. Upper part of the neck

carefully dissected. Stenson's duct and facial nerve divided, as they were involved in the disease. A few small glands were removed near the tumor. The wound healed quickly. She left the hospital one week after operation.

A year and a half following the operation examination finds no recurrence at the seat of the original disease. The cicatrix is soft and unattached to the parts beneath. There is a right facial paralysis.

FIG. 2.



Tuberculosis of the parotid gland. Parotid and tubercular tissue seen.

"*Pathological Report.* A fragmentary tumor from the parotid region. Microscopic examination showed parotid gland structure in which were numerous small foci composed of epithelioid small round and numerous giant cells, with cheesy degenerations. Tuberculosis.

"W. F. WHITNEY, M.D.,
"*Pathologist.*"

THE PRESENT STATUS OF SERUM THERAPY.

By Frederick A. Packard, M.D.,

AND

Robert N. Willson, M.D.,

OF PHILADELPHIA.

While the intelligent application of serum therapy—meaning by the term the prophylactic and curative use of sera obtained from artificially immunized animals—can be traced back only to Pasteur and the discovery of bacteriology, yet Pasteur and the scientific light shed by his studies formed only the full daybreak following upon a glimmering that was evident as early as the days of Mithridates and his empire.

We find numerous references in ancient historical and general literature to a partial hold upon certain facts bearing upon therapy and medical science that are even to-day far from being understood, and to principles that seem only now on the verge of perfect development. It is stated, for example, that Mithridates believed it possible to render himself proof against all forms of poison by the constant and daily use of small doses of various poisonous principles. He also compounded a general antidote by combining all forms of poisons then known. To this he added the blood of animals that had fed on poisonous adders, using the final product as an antidote and also as a preventive for poisoning from snakebite. In cultivating the blood for this remedy he used geese, reasoning that they were exceedingly resistant to the bite of the viper, which formed one of their chief articles of diet, so their blood must contain some antidotal quality or substance that would prove useful in his poison panacea.

Lambadarios, in a recent article, also reminds us that Dioscorides treated hydrophobia by administering the blood and cooked liver of the dog that had been guilty of the biting.

Without dwelling upon the announcement of Toussaint that he had produced immunity to anthrax by means of a sterilized culture, and of Pasteur that he had obtained a serum curative for the same disease, and of Behring's antidiphtheritic serum, and, later, of Marmorek's, Yersin's, Haffkine's, Sclavo's, Kitasato's, Chantemesse's, Pane's, Calmette's, and others' sera—without dwelling upon these, we can proceed immediately to the discussion of the present development of sero-therapeutics and to a consideration of the directions in which still further development is likely to take place.

There still remains the division between the two schools, represented on the one hand by Roux, Calmette, and the French investigators,

who claim that there occurs an actual tissue change (particularly a leucocytic activity) as the means by which the antitoxin causes a destruction of the toxins by the generation of neutralizing substances in the parenchyma of the cells, and, on the other hand, by many English and German students, who claim that the influence of the antitoxin upon the toxin is a purely chemical one, the tissues themselves remaining passive.

Martin and Cherry, Ehrlich, and others have demonstrated that the antitoxin unquestionably exerts a chemical action upon the toxin. It still remains to be proven, however, that there is a total absence of tissue activity; and present indications, as well as the latest experiments in the field of animal research, seem to point toward a conjoint action of leucocytic and chemical forces.

Many terms have been employed that have tended rather to obscure than to simplify the development of the problem of serum therapy.

Toxins, antitoxins, alexins, zymoses, ferments, immune bodies, end-bodies, the lateral-chain theory—all carry their special meaning to those who have followed a particular line of study from start to finish. But the main fact with which we have to deal in every infection is that bacteria are in evidence as well as their toxins; and the fact that sera do not always or even usually combine a bactericidal with the antitoxic action has frequently been overlooked, thus retarding the advance of our knowledge of the working of immune sera to no trifling degree. For example, anticholera serum seems to have both a marked bactericidal and antitoxic power, while antitetanus and other sera have little or no effect upon the micro-organisms in the human tissue. In short, a human being, like laboratory animals, may be completely immunized with large doses of such an antitoxic serum, and yet contract and die as the result of a bacterial infection, and *vice versa*.

Perhaps it will be well to explain in a few words at this point Ehrlich's lateral-chain theory, which offers, perhaps, the most satisfactory, although characterized as the most fanciful, explanation of the antitoxic action that has yet presented itself. Avoiding all unnecessary terms, it may be stated as the theory that every toxin is composed of two groups of constituents—a toxaphore group, that exert their toxic influence directly, and a haptophore group, the function of the latter being to combine the toxic element with the tissue cells of the organism attacked.

Ehrlich claims that when the cell is attacked the haptophore or combining molecules of the toxin attach themselves to a similar combining group in the cell itself, which are soon destroyed by means of the toxaphore molecules. As soon as these molecules are destroyed there is a prompt and profuse regeneration under the influence of the tissue change, just as connective tissue proliferates as the result of parenchy-

matous inflammatory processes. Ehrlich simply looks upon these regenerating molecules as reproduced in side chains, which overgrow and are carried away in the circulation. Only when they have left the mother cell do they assume a protective function and become the substance that we know as antitoxin. They still retain their attractive power for the haptophore group of the toxin, and by combining with these molecules before they reach the cells they use up, as it were, their (haptophore) entire combining power. In this way they prevent the action of the toxaphore group again by preventing their combination with the living tissue.

Antitoxic therapy, therefore, is seen to depend upon a simple contest between the affinity of the combining (haptophore) group of the poison (1) for the cells themselves, (2) for the side-chain molecules in the blood —*i. e.*, the antitoxin.

If the affinity of the haptophore group is greater for the cells than for the antitoxin, combination takes place with the cells, and infection is under way; if the affinity is equal for both, the result is good, because the antitoxin molecules are the first to come in contact with the haptophore group, and have the first opportunity of combining with the latter; if, finally, the affinity is greater for the antitoxin than for the cells, the state of affairs is ideal. Such a state of circumstances is seen, however, only when the antitoxin is present in enormous quantities.

In the case of bactericidal sera the action is entirely different. Here we do not have to consider the combination between the side chain of antitoxin molecules and the haptophore group of the toxin, but the bacteria and their destruction. Ehrlich and Morgenroth, as well as Wassermann, have shown by experiments that in the action of every hæmolytic and bactericidal serum there are involved a substance to which they have given the name of "immune body," and a second substance which they name the complement. The immune body is fixed in a fast chemical combination in those red corpuscles for which a given serum is most hæmolytic, and when the serum is not strongly hæmolytic the immune body leaves the cells and is contained in the serum. (Ehrlich and Morgenroth.) The function of the immune body is to bind the complement to the bacterium, and thus enable it (the complement) to destroy the latter. The immune body is a substance present in the blood during infections, which withstands the effect of heat at 55° C., and which has an affinity for the bactericidal substance found in normal serum.

The "complement" already mentioned corresponds very nearly with the substance called alexin by Buchner and others, and is the bactericidal agency found in every normal serum. It is probably a ferment, being destroyed by temperatures of 55° C. and over, and only

acts in co-operation with the immune body which binds it to the bacterial cell.

Wassermann calls attention to the facts learned from the experiments of Ehrlich and Morgenroth, Bordet, Buchner, Behring and Kitashima, and himself, to the effect that the influence of the hæmolytic or specific bactericidal sera depends upon the co-operation of the immune body and the complement; also, that in an immune (specific) serum one specific binding body is increased, this being its only difference from the normal serum; and, finally, that in old, immune sera there is only the binding body present, the complement soon losing its power.

As the results of his own experiments Wassermann has recently concluded that: (1) Complements are always present in the normal body; (2) they are not the only means of natural resistance, since in certain forms of congenital immunity it cannot be ascertained that there is any complement involved in the process of immunity; (3) large doses of the immune body increase the affinity between it and its complement; (4) in the action of specific sera the complement takes no part; and, finally, (5) a certain, though not the only, source of the complement is the leucocytes.

In short, we may look upon the most recent experimental teaching as showing that in every infection the tissue cells produce and give out in some quantity a substance (probably a ferment) that tends to destroy bacteria by the joining of this ferment (the end-body or complement) with and by its destructive action upon them. When an infection takes place a second substance (the immune body) is produced, which binds the destroying substance to the bacteria and enables it to act upon the latter. This second body is probably never found in the normal economy, though the ferment or bactericidal substance is present in the leucocytes and probably in some quantity in every normal cell.

A great hindrance to the development of serum treatment up to the present time has been our failure to consider the constant lack in infections of sufficient quantities of both the binding body and the complement, though Wassermann has, as stated, shown in a series of experiments that they can be supplied, and that by means of their addition results can be obtained that have heretofore seemed impossible. He has found that by injecting normal serum (thus supplying the end-body or complement) together with immune serum he can immunize animals against virulent cultures and toxins that produce early death when combated by the immune sera alone, which contain little else than the immune body or the binding substance. Ehrlich's theory that the difference in the species between the animal to be immunized and the man to be protected or cured forms a barrier to success led to

many experiments on Wassermann's part, and at last brought him to the conclusion that normal sera can always be found to act with the immune sera and add to their power. Thus he found that normal serum from cattle (beef) could be used with typhoid immune serum—*e. g.*, that guinea-pigs injected with three loops of living culture (typhoid), and in a half-hour with 0.5 c.c. of typhoid immune serum mixed with 4 c.c. of fresh normal ox serum, all survived in good health, while control animals injected with normal serum or immune serum alone all died in twenty-four hours. He suggests the monkey as the nearest animal in kin to the human being, and that its serum may be found to supply the elements that are needed to combat an infection. Metschnikoff and others have recently claimed that the serum of animals when treated with blood cells from another species has a distinctly destructive action on these same cells when it is used in large quantities, but that a small amount of this "cytotoxin" stimulates the production of new cells. Lucatello tested these claims on four anæmic children, and published results that completely confirm the statements of Metschnikoff. Dogs were injected in the peritoneum with the blood of the patient. Their serum acquired the property of stimulating the blood production when transferred to the patients again in doses of 0.3 to 2 c.c. subcutaneously. The number of red corpuscles increased nearly to normal, with a slight leucocytosis, and the improvement lasted about two weeks. The influence appeared to be cytogenic rather than hæmoglobinogenic.

Another line of experiments has been carried on by Wlaeff and Villiers, with the object in view of immunizing animals (pigeons, hens, and geese) with blastomycetes derived from malignant tumors. Injected into patients suffering from malignant growths, the serum of such animals has seemed to arrest the growth and to lead to retrogression in many cases. Wlaeff claims that the improvement is often so marked as to render an inoperable tumor operable, while the subjective symptoms are always relieved. This serum, of course, has no scientific ground or reason for success, since the causal connection of the blastomycetes with carcinoma is far from having been demonstrated. The effect, however, has undoubtedly been a satisfactory one, and enough opportunity has been afforded to prove that Wlaeff's claims are clinically well grounded. He reports at a later date the results of experiments on 510 animals with cultures of blastomycetes from the Pasteur Institute, the Prague Institute, and with a culture isolated by Plimmer from a carcinoma of the mamma. He treated forty cases of malignant neoplasm with "anticellular serum" obtained from the immunization of geese and asses over a period of a year's time, and secured appreciable results in every case. The intensity of the reaction seemed dependent upon the condition of the patient. Widal and others highly

commend the serum as the result of their experience in its use. We find, however, no record of its use in this country up to the present time.[1]

The purpose of this paper is, however, not so much to review the enormous and ever-widening field of serum experiment, even where it has been applied to therapy, but to note the clinical evidence for or against the efficacy of such sera as have become more or less known, and by presenting this casual evidence assist in bringing a new and constantly more valuable therapeutic measure into general use throughout this country and the entire world. Among those which have given promise of more or less certain value we shall consider the antibacterial sera, such as the antipneumococcic, antityphoid, and antiplague; and among the more purely antitoxic forms such sera as the antitetanus, antidiphtheritic, and perhaps the anticellular, though, as stated, the action of the latter is hardly understood.

In estimating the value of these sera it has been considered best by the writers to limit their review of the subject almost exclusively to cases treated and studies reported within the years 1900–1902, inclusive; first, because a distinct advance in serotherapy has been accomplished during this period; and, secondly, because an attempt at covering the entire literature of the subject would prove much more cumbersome and tedious than profitable. An attempt has been made, therefore, to collect reports of cases—and especially series rather than isolated instances—in order to gain both clinical and experimental evidence of the progress of this form of treatment. Certain antitoxins had thoroughly established their place and value in therapeutic medicine previous to the dates mentioned, as, for instance, Behring's antidiphtheritic serum. To these only such reference will be made as may seem of advantage from the standpoint of statistical thoroughness. Other sera have been used to a great extent in the old world and also here, and to these we shall give more attention.

Antidiphtheria Serum. At the present time little need be said of the value of antidiphtheria serum when properly prepared and preserved. A measure which has reduced the mortality in all forms of diphtheria from 40 per cent. or more (Welch) to 15 per cent. and often less, and exclusive of laryngeal and operative cases to 5 per cent. and less, needs at the present day no recommendation. There still is heard, however, an occasional voice in opposition, such as that of Lennox Browne, who states that in London the mortality

[1] Since the preparation of this article Von Leyden and Blumenthal have reported (Deutsche med. Woch., September 4, 1902) interesting results obtained from human inoculations with the serum expressed from carcinomatous tissue. In a number of cases gratifying improvement was obtained, and in no instance did metastasis or any injurious effects follow. We suspend final judgment, however, until further observation may confirm the report.

(without antitoxin) seldom passes 20 per cent.; and Bayeux (quoted by Grasset), who reports the general diphtheria mortality of the entire world as only 16 per cent. Comprehensive figures hardly bear out their statements as to the value of the antitoxin, and when the influence of the still more recently introduced preventive inoculations is considered, their objection loses its at best trifling weight.

A few of the recent statistics that carry convincing evidence of the value of the antidiphtheritic serum and its use over an everspreading area are the following:

The American Pediatric Society reported, through its committee, in 1900, a summary of 5794 cases from the practice of 615 observers, and two city boards of health, with a mortality of 12.3 per cent. Deducting 218 cases that were moribund at the time of the injection, the mortality was 9 per cent. Burrows reports 1963 cases, with 249 deaths (mortality, 12.23 per cent.); Goodno, 214 cases treated by himself, with 9 deaths (mortality, 4 per cent.); Richardiere, 1778 cases from the Hôpital Trousseau, with a gross mortality of 15 per cent. (excluding moribund cases, 11.5 per cent.; and in 1115 non-operative cases, 5.5 per cent.), and a mortality in operated laryngeal cases of only 27 per cent.

Most interesting figures are quoted from the municipality of Muhlhausen, Germany.[1]

These figures include all cases of pharyngeal and laryngeal diphtheria, those occurring during 1899 and 1900 being of an unusually severe type. Escherich reports from Germany, during 1901–1902, 115 patients treated and 54.8 per cent. cured. Since then 1147 patients and 86.92 per cent. cured, including 80.42 per cent. of recoveries in 378 cases of progressive croup, and 57.38 per cent. in 176 cases of septicotoxic type. He has had one fatality from the use of the antitoxin. Netter, Porter, Voisin, and Guinon all report favorably their results with prophylactic injections, from 1 to 6 per cent. of failures occurring in patients exposed to the disease. In this country in many city hospitals preventive injections are given to every child admitted, and in certain cities at intervals of several weeks or months as long as the child remains in the hospital. By these means diphtheria has almost been stamped out as an epidemic disease in hospitals of the larger cities. In France physicians have met with the same experience, a resolution having just been recorded (1902) by the Académie de Médecine recommending the injections as harmless and effective—

[1] Editorial in Journal of the American Medical Association, April, 1902:

Mortality in 1892 . . .	53.4 per ct.	Mortality in 1897 . . .	16.0 per ct.
" 1893 . . .	55.3 "	" 1898 . . .	20.0 "
" 1894 . . .	51.7 "	" 1899 . . .	15.1 "
" 1895 . . .	38.5 "	" 1900 . . .	18.7 "
" 1896 . . .	28.8 "		

not by way of enabling one to dispense with other measures, but by augmenting and supplementing the latter.

Geffrier and Rozet have still more recently advised care in the use of Roux's serum, and claim that as accidents may follow any dosage, small injections should be employed. In their hands the serum has appeared to aggravate renal symptoms, and in 13 cases it seemed to be the cause of anuria, 4 of these being personal cases. They do not advise the prophylactic use even in small doses.

F. Siegert publishes the statistics from five children's hospitals during the period 1886–1900. In all, 17,626 children were treated for diphtheria. In 1894, when antitoxin was first used, there was a marked fall in the mortality of the disease. During 1892–94 over 2000 died out of 4894 cases. During 1895–97 only 817 died out of 4143 cases. These figures leave no doubt as to the value of the then comparatively new measure. Very rarely has a case died as a result of the injection. Just what process takes place at such times and how and why a seemingly harmless substance now and then takes on fatal qualities remain among the mysteries that must yet be solved. Geffrier's cautions, however, seem entirely out of place and exaggerated, and the benefits have so far outweighed the slight danger that the latter has almost faded out of view.

During the last two years antidiphtheritic serum has also been applied to the treatment of other conditions than diphtheria. Talamon and Raynaud both report cases of pneumonia (double and unilateral) treated in this way. Defervescence was prompt, and recovery followed. Landrieux and Legros injected antidiphtheritic serum in 10 cases of pneumonia, of which 2 severe cases were fatal. In 8 cases, in which the injections were begun during the third to the fifth day from the beginning of the disease, a sudden fall was noted in twenty-four hours after the second injection; but the same fall was noted when cold applications were used and no serum.

Indica had, in 1900, also used the same serum in 7 cases of severe pertussis (in 10 c.c. doses), and obtained a marked effect in lessening the symptoms and abbreviating the course of the disease.

As already stated, the position of antidiphtheritic serum is already such a well-established one in the modern system of the therapeutics of diphtheria that these figures are needed simply to witness the fact that its value is an increasing one and that it has revolutionized the treatment, and with it the prognosis, of the disease; also that its applicability may yet be found to extend beyond the one condition.

Antitetanus Serum. In studying the statistics of cases treated with tetanus antitoxin during the past two years we meet with our first discouragement, and perhaps with the most decided one that has confronted us in serum therapy. Many cases have been reported treated

with the various brands of antitoxin, and from the different corners of the globe come as various reports of their efficacy. In Italy tetanus seems to be a disease that is more or less amenable to treatment of any sort. Bacelli's carbolic acid treatment, as well as Tizzoni's and Behring's antitetanus sera, all seem to control the disease in a way that is impossible to understand in the United States or Germany, where there seems to be as little success in the treatment as here. For example, Bacelli states that of 40 cases of tetanus treated with carbolic acid subcutaneously only 1 died; and Pinna notes statistics, compiled by Ascoli, of 33 cases treated by Bacelli's method, with only 1 death; of 47 cases treated by Tizzoni's antitoxin, and 36 recoveries; of 33 cases treated with Behring's serum, and 20 recoveries. Tizzoni reports 33 cases, all of which recovered under treatment by his own serum. Holsti, however, states that in Germany, Austria, and France the mortality with the same treatment varies from 41 per cent. to 64.7 per cent. The latter figures resemble closely those of our country, and a study of the cases reported in the last two years gives a percentage mortality, with the use of the various antitetanus sera, of about 42 per cent. Many factors, however, destroy the value of statistics. In many—we might say all—the serum is used far too late to accomplish its best good; in many others it is used in far too small doses and over too short a period; and no doubt in some instances the serum is of low potency, if, indeed, it retains or ever possessed any value. In contending with the tetanotoxin the problem has been one of immense difficulty in that a treatment has been required for a disease that has become uncontrollable before its symptoms are clear. To overcome such a condition forces are required that will not be and have not been secured with ease. Many cases have been handled with large doses of potent serum from the first appearance of the tetanus until death ended the treatment. The writers saw just such a case in a child —a victim of tetanus infection, in the course of vaccinia—during the past winter. Not only large (adult) doses of antitoxin, but full hypodermic doses of carbolic acid and rectal suppositories of chloral and bromides were used, and to no avail. One of the writers has recently collected 52 cases of so-called vaccine tetanus, dating from the years 1889 to 1902, inclusive, with a general mortality of 78.8 per cent.: 39 of these were treated by the ordinary method (without antitoxin), with a mortality of 82 per cent.; 13 were handled with antitoxin, with a mortality of 76.9 per cent. (10 died, 3 recovered); of the latter, 1 (an adult) was injected with an immunizing dose several days before the tetanus appeared, and thereafter throughout the course of the disease, and death resulted. The series as a whole gave a percentage mortality of about the type seen in cases formerly treated without antitoxin in time of peace. The series treated with antitoxin is too small, however,

to be of great value statistically, though it is interesting on account of its high percentage mortality, 77 per cent. instead of 30 per cent., as often claimed, or 0 per cent., as published from some of the Italian districts. So many of the foregoing cases occurred in children that the susceptibility of childhood must also have exerted its influence upon the figures.

It is interesting to note that three different methods have been used in the main for the administration of the antitetanus serum—the subcutaneous, the intracerebral, and the subarachnoid or spinal. Krokiewitz has also suggested an injection of the emulsion of brain substance, to which reference will be made at a later point. Among the experiments that have been carried out warranting these various methods brief reference may be made to the work of Roux and Borrel, who infected 45 guinea-pigs with tetanus, then trephined and injected antitoxin directly into the brain, and saved 35. Of 17 others injected subcutaneously only 2 lived, and of 17 control animals under no form of treatment, all died. Blumenthal and Jacob tetanized a series of goats, and after waiting until tetanic symptoms appeared injected antitoxin into the subdural space, not one recovering. Kitasato and Behring showed long ago that animals could be immunized against tetanus, and many instances of local tetanus infection in human beings have demonstrated that the same is possible in man. Letoux has recently experimented with animals and man with intracerebral injections, introducing early in the disease 20 c.c. of antitoxin into each hemisphere in the most prominent portion of the frontal eminence. He claims that the serum does not cure the nerve cells that are already affected, but protects those that survive; that subcutaneous injections have no effect upon the toxin except while it is *en route* from the primary wound to the nervous centres, and that once the symptoms have appeared the damage is done; that intracerebral injections are actually curative, while the subcutaneous administration of serum is only protective. Rostowtsev supports this view. Behring has shown that tetanic antitoxin can exert an active influence when applied directly to infected tissues—*i. e.*, the point of infection and its vicinity, as the vagina in puerperal tetanus, or the peritoneum in tetanus neonatorum. He has found that a dilution of 1 to 10 or 1 to 100 is sufficient for this purpose.

Wassermann and Takaki have shown that nearly all the toxin is taken up by the nervous tissue, proving this by emulsifying the brain and spinal cord and centrifugating. The nervous tissue sinks to the bottom, and the upper clear fluid is used for inoculation purposes. In their experiments this proved harmless to small and susceptible animals, while the nervous sediment promptly killed the same animals with typical tetanic contractures. Stintzing has shown that the spinal

fluid contains more of the toxin than the blood at any given time. Castronuovo has demonstrated that the antitoxin has no effect in saving the lives of tetanized animals in a fasting state. Bolton and Fisch have demonstrated within the last few months some very interesting facts with regard to the presence of the toxin in the blood of infected animals. They found that in guinea-pigs the toxin is present in the blood constantly after the injection. Two horses were inoculated with garden earth known to contain the tetanus organism from the results of tests on small animals. One horse was inoculated with earth that had produced tetanus in smaller animals; one had become accidentally inoculated. The blood from all four horses was drawn at an interval of twenty-four hours after inoculation, and the amount of toxin in the serum determined by injection into guinea-pigs and other animals. The minimum fatal dose obtained from one of the horses was 1.5 to 2 c.c. for a guinea-pig weighing 300 grammes.

The toxin appears to be present in the blood of the horse several days previous to the symptoms; it then increases in amount until symptoms appear, when it decreases, until at the time of death it has almost disappeared. From their experiments it is inferred that it is difficult to inoculate horses with earth containing the tetanus bacilli, though horses are accidentally infected with no great difficulty and are very susceptible to the disease. In the discussion of this paper Abbott said that he had examined the heart blood of a child within twenty-four hours after death from tetanus, by injecting it into white mice, but no tetanus developed.

Much in the same line were the experiments and conclusions of Zupnik, also published within the current year. He concludes that the poison leaves the wound and is distributed to the musculature of the body by the blood current. It gradually accumulates and forms chemical combinations in the muscles. Hand-in-hand with this accumulation and chemical change the contractures of the muscles increase. This naturally becomes first evident to the patient where the greatest discrepancy exists in the balance of muscular power (the jaw and back have no antagonistic set of muscles). He finds, moreover, that the toxin attacks the muscles first, and only later the central nervous tissues, especially the motor ganglia of the spinal cord; also that both tissues receive the toxin through the blood circulation. Local tetanus he believes to be caused by a direct influence of the toxin, the ascending or descending type being produced by the course of its progress through the muscular tissues. The incubation period consists, according to this view, of the time necessary for the chemical reaction between the tissues. His conclusions agree with those of Ransom in regard to the fact that small quantities of toxin reach the subarachnoid space by way of the connective tissue of the peripheral nerves, and are then

given out through the circulation to the spinal cord. Zupnik also thinks it possible that there is only one toxic principle. In this event the different sets of symptoms are caused by physiological differences in the reaction of the toxin with the various tissues; or there may be two toxic principles, of which one has a special affinity for the muscles and the other for the cells of the spinal cord. Buchner also holds the theory that certain cells are affected by the toxin, and that these cannot be relieved of the effects of the poison by the antitoxin, but that certain cells are also immunized by the antitoxin, and that these cannot be affected by the toxin. In the latter possibility rests the usefulness and need of early administration of the serum.

We have mentioned these studies—some very recent, some dating as far back as 1898—simply to introduce and explain the statistics that follow, and with a view to explaining the success and failure of the various methods used in treating the disease.

In our studies of the cases reported during 1900–1902, inclusive, we obtain the following figures: Of 1216 cases collected (including 290 cases gathered by Moschcowitz and other similar series reported by different observers) treated with antitoxin by the various methods we find that 702 recovered and 514 died, giving a mortality of 42.2 per cent. Very few cases have been reported during this time in which the antitoxin treatment was neglected, and we have been able to collect only 67 in the literature at our command. Of these 18 recovered and 49 died, giving a mortality of 73.1 per cent. This discrepancy in the percentage mortality, however, may appear greater than it actually should. The latter series is so small, and the tendency to report unfavorable cases so slight, that we have hardly adequate material for a proper comparison with a series of such dimensions as that included under the antitoxin treatment; we are therefore driven to a comparison of older records for information as to the percentage mortality of tetanus previous to its treatment by antitoxic sera. Moschcowitz states that Richter collected 717 cases, with a mortality of 88 per cent.; that Behring gives a mortality of 80 to 90 per cent.; Gower one of 90 per cent.; Raynaud of 90.5 per cent., and that Dean has obtained from a study of all the cases in the London hospitals in sixteen years a mortality of 80 per cent. Probably the latter figure is much nearer the average death-rate than the higher figures quoted above. Lambert notes 1222 cases occurring in war surroundings (mortality, 88.6 per cent.) and 280 cases in time of peace (mortality, 76 per cent.). His own experience includes 35 cases, with a mortality of 83 per cent. The general mortality of tetanus in the Civil War (505 cases) was 89.3 per cent. Lambert has also published a series of 262 cases treated with antitoxin, with 151 recoveries and 111 deaths—a mortality of 42.36 per cent. (in the acute cases of 72 per cent. and in the subacute and

chronic cases of 16 per cent.). Nearly all observers who have reckoned from a considerable number of cases agree with him in his figures, so that we shall not occupy time and space by adducing other names and statistics.

From a study of as many authorities as it was found possible to consult, we find it the general consensus of opinion that the mortality of tetanus prior to the introduction of antitoxic serum was between 70 and 90 per cent. (usually approaching the lower figure); of the acute form, between 80 and 90 per cent., and of the chronic form, 25 to 40 per cent. Lambert states the former mortality of the disease as 88 per cent., and of the chronic form as 40 per cent. In any event, statistics seem to denote a reduction in the general mortality from the conservative figure of 80 per cent. to one between 40 and 50 per cent.; of acute tetanus from 90 to 70 to 80 per cent., and of chronic tetanus from 40 per cent. to about 20 per cent.

Moschcowitz cites the mortality in cases treated with antitoxin by various observers as follows:

	Cases.	*Mortality.*		*Cases.*	*Mortality.*
Marsden . .	38	34.2 per ct.	Wellner . .	94	45.0 per ct.
Hewlitt . .	42	36.0 "	Weischer . .	98	41.8 "
Engelmann .	54	29.6 "	Holsti . . .	171	43.2 "
Kanthack . .	54	37.0 "			

It would seem, therefore, that we have in tetanus antitoxin not a specific, because it fails too often to have merited such a name, but a valuable remedy in the treatment of the disease, and one that cannot be neglected until a better is supplied. Unfortunately, tetanus antitoxin deteriorates rapidly, and often it seems inefficient at the start, possibly because of careless methods of production. There is also an unquestioned difference in the potency of tetanus toxin used in the immunization of animals. Tizzoni has experimented with his own and Behring's toxins, and, allowing for the deterioration to be expected from age, concludes that his own is 166 times as pathogenic for animals (such as rabbits) that are not especially susceptible to the disease, and only three-fifths as pathogenic for those (guinea-pigs) which are most susceptible. Behring in testing his own and Tizzoni's antitoxin finds that the latter is very weak (as well as Tizzoni's toxin). He also states that 700 c.c. ($\frac{3}{4}$ litre) of foreign antitoxin would have to be injected to obtain 500 Behring units such as are contained in 50 to 100 c.c. of Behring's serum.

Pfeiffer, as an impartial observer, reports 22 cases, and has collected 93 others treated with the antitoxins prepared by Tizzoni and Behring. He states that the mortality of those treated by Behring's serum was 52.7 per cent., and only 36.3 per cent. in 88 cases treated with Tizzoni's antitetanus serum. He remarks, as we have stated above, that tetanus

evidently runs a milder course in Italy than elsewhere. Omitting the 21 cases reported by Italian physicians, the mortality of the series is 46.2 per cent. In 14 of his personal cases in which antitoxin was not used the mortality was 50 per cent.

We may also state that of the 338 cases collected by Moschcowitz—

76	treated with	Tizzoni's serum	53	recoveries,	23 deaths.
61	" "	Behring's "	35	"	26 "
39	" "	Pasteur's "	25	"	14 "
28	" "	Br. Inst. Pr. Med.	16	"	12 "
27	" "	Roux's	9	"	18 "
10	" "	P., D. & Co.	8	"	2 "
8	" "	New York Board of Health	2	"	6 "

With regard to the method of administration, it must be said that the subcutaneous injection has been used so greatly to the exclusion of the intracerebral and the subarachnoid, that we have only the reports of scattered individuals to witness the value of the two latter. In the series of cases collected by the writers 233 were treated by the intracerebral method, with 96 recoveries and 137 deaths, giving a mortality of 58.7 per cent. The cases treated by subarachnoid injection numbered 40, with 25 recoveries and 15 deaths—a mortality of 37.5 per cent. Seventeen cases were injected with brain emulsion, with a mortality of 23.3 per cent.

P. Jacobi (1902) reports two cases treated by injection into the spinal canal, and states that this method has been successful in two-thirds of all cases thus far treated at the Charité. Five to ten cubic centimetres of cerebrospinal fluid are withdrawn and ten to twenty cubic centimetres of antitoxin injected very slowly under weak pressure. Schultze injected Behring's serum into the spinal canal also in a case in which, immediately upon the injection, the contractures spread to other muscles than those already infected. The case ended in recovery, however, and Schultze prefers this method to that of intracerebral injection. Two cases were also successful in von Leyden's clinic. Later, von Leyden and Blumenthal reported 9 cases, of which 3 recovered and 6 died. Successful cases have come from von Jaksch's and Kast's clinics. Von Leyden reports 24 cases in which antitoxin was injected into the brain, with 6 recoveries; also 11 cases of spinal subarachnoid injection, with 5 recoveries. Parry has collected 26 cases treated with intracerebral injections, of which 17 died and 9 recovered. He states, however, that they were isolated cases, and not a series, and that there is always a tendency to report successful cases and withhold the fatal ones. Five cases are also reported by Loeper and Oppenheim, four of which recovered. The fifth was trephined and the serum injected into the brain substance, the case terminating fatally. Both writers have used the serum subcutaneously, and now suggest intravenous injection as perhaps more efficacious. Penna

reports 5 cases of subarachnoid treatment, with 3 recoveries. The other two died of pneumonia after the tetanic symptoms had subsided.

Pfandler reports 3 cases of tetanus neonatorum treated by subarachnoid injections, with marked beneficial influence in all 3 cases. McCaw also reports a recovery in an infant after the subcutaneous injection of 5 c.c. of serum from the Pasteur Institute.[1]

A number of cases have been reported in which the antitoxin has seemed to fail and in which the patient has rapidly improved under another form of treatment. Such a case was treated by Laplace, violent convulsions seeming to have been excited by the serum injection. As no improvement followed large doses of the antitoxin, it was relinquished; the cases then promptly improved and recovered under carbolic acid hypodermic injections. Whitridge also cites a case in which absolutely no result was obtained with the serum treatment. The latter was then stopped, and under large doses of morphine the case slowly recovered.

We have spent considerable time and space in considering the antitetanic serum, because small series of cases, and especially those of the past two years, would tend at first sight to discourage its use. Only by a consideration of a large number of cases is its real value discovered. Its influence appears to be appreciable mainly in cases of the subacute and chronic type, the mortality in acute cases still remaining very high. Even here, however, there has been a real reduction, and occasionally a result has been accomplished that has seemed to be entirely due to the serum, and one that must encourage the physician and the experimenter in the laboratory to new efforts at early diagnosis and thorough serum treatment. Large doses used thoroughly will influence many cases if anything will; and as the serum is harmless, it can be used without stint, only the expense standing in the way of a thorough saturation of the patient and his circulatory and nervous system. Too many cases have been treated with one or at best a few small injections, and the serum has been discarded because failure has resulted. Such cases might have occasionally been saved by proper serum treatment. It is our belief that the treatment of tetanus—at least until a more potent serum is found than any yet produced—to be uniformly successful must be a prophylactic one, and that we must take advantage of the powerful immunizing qualities of the serum. When a wound is received that suggests in any way a possible contamination with the tetanus organism or its spores the patient should be given a full immunizing dose of the serum. In most if not all such cases there will be a prevention of the disease. That this is not the invariable result is witnessed by a case that occurred in Reynier's service,[2] in which several cases of post-

[1] Cited in the Journal of the American Medical Association, September 28, 1901.
[2] Widal: Presse Med., March 13, 1901.

operative tetanus had already appeared. With a view to preventing another such mishap, Reynier injected an immunizing dose of antitoxin before the operation. Notwithstanding this, tetanus developed, though the case ran a mild course and recovered. There will also be cases that cannot be foreseen, and therefore cannot be prevented; but these will not aggregate a large total, and many a life will have been saved. In regard to this as well as to all other sera the tendency to report only favorable cases must be borne in mind; this renders it impossible to express in figures the exact value of the serum. Our object has been to present the case as accurately as possible, with inaccurate statistics for our basis of calculation.

Antityphoid Serum. The development of a typhoid antitoxic serum has proved even more disappointing than that of antitetanus serum until a very recent day. At the present time, however, it seems possible to say, and still remain within conservative limits, that we have at hand an active though by no means perfect prophylactic in the shape of the sterile cultures of the bacillus, as well as the immune horse serum, and the prospect, at least, of a positively curative serum. The difficulty with the serum treatment of typhoid fever has rested in the fact that the serum to effect a cure must be equally an antitoxin and a bactericide. Fraenkel, Pfeiffer, Levy, Chantemesse, Widal, Bokenham, Wright, and many others have produced and used sera which they believed would accomplish the cure. None succeeded with any measure or constancy of success until Bokenham and Chantemesse, at about the same time, succeeded in immunizing horses with typhoid cultures, and obtained a serum that would save guinea-pigs and other susceptible animals from typhoid infection, even when the disease was already under way. We will confine our discussion entirely to the use of the serum, omitting until its close all reference to the protective inoculations with sterilized cultures. Without question, Chantemesse and Bokenham seem to have come nearest to the production of curative sera; and Chantemesse's latest communication, in November last, would seem to indicate that he had put his product to a satisfactory clinical test. Since 1892 he has been at work upon the subject, and in 1897 he claimed to have isolated the true soluble typhoid toxin, and began at once to use it in experiments with a view to producing a serum for clinical use. He cultivated the bacillus upon a filtrate of emulsion of splenic tissue digested with pepsin, carefully avoiding the admission of air. The fluid was very toxic, but on exposure to air lost its poisonous properties. Horses seemed to be very susceptible to very minute doses for a year, then became gradually immune, while their blood serum became strongly bactericidal and both curative and protective for animals. Chantemesse reports the use of this serum in 100 cases of severe typhoid fever, and records also the results with other methods. In 371

cases treated by ordinary means in nine hospitals in Paris (January 1 to October 10, 1901) the mortality was 12.28 to 56 per cent., and averaged 29 per cent.; and of 404 cases treated at a children's hospital the mortality was 10 per cent. His 100 cases were treated with the serum, and of these all that were treated before the tenth day recovered, and all the others except 6; 2 of the latter had serum treatment only at the twenty-first day, 1 died of pneumonia, and 1 of a pre-existing extensive gangrenous sloughing. All of the 100 cases were serious clinically, and all were in hospital practice except 10, which were seen in private work. As a rule, the injection was followed in a few hours by a slight febrile reaction. In twenty-four to thirty-six hours the general condition was markedly improved. A marked defervescence occurred, and there seemed to be a decided diuretic effect. If a relapse occurred it was more severe than the first attack, but a second injection always caused a second rapid fall. Perforation occurred in 3 cases only, and in no case that was injected before the ninth to the tenth day. Chantemesse injects the serum at the elbow, because the venous plexus is so extensive here as to offer a better absorbing area than the abdomen. There were no after-effects except a slight erythema. He gave 10 to 12 c.c. to adults (vigorous) as the usual dose; and if after a week the temperature was still up, 4 to 10 c.c. were again given, according to the height of the fever. If the disease is only five days old, Chantemesse recommends the use of only 6 to 8 c.c. at the start, and a repetition of the dose later. When the reaction is marked he suspends all food, and gives water alone.

E. Aimly Walker has also shown that it is possible to secure a curative serum, and in his discussion repeats Chantemesse's statement that this must be a bactericidal as well as an antitoxic serum. His conclusions, based on laboratory and clinical studies, are as follows: (1) That a serum with antimicrobal and antitoxic power can be obtained by immunizing horses against the bacillus typhosus; (2) that a high degree of immunization must be obtained, and the employment of living cultures in the later stages is desirable; (3) the serum must be made widely polyvalent by the use of as many and as widely different races of the bacillus typhosus as possible; (4) the relative value of the serum may be determined by its relative agglutinating power.

Tavel emphasizes in like manner the need of a polyvalent serum. He has experimented with the serum of horses immunized over the course of a year, and has obtained decided curative results and a most marked action in the reduction of the fever.

James Ewing states that Walker has now in preparation a two or three-year polyvalent serum. He also calls attention to the fact that the recent recognition of infections indistinguishable from typhoid fever, and yet due to bacilli that fail to agglutinate with typhoid

serum, and fail also in other ways to correspond with the typhoid bacillus, will throw new difficulties in the way of a perfect result; and yet even with this discovery of a discouraging feature, the outlook seems to be very bright for a genuinely curative measure for typhoid infection.

Jez's antityphoid extract is so closely related to the true sera that it deserves a word of mention. Since his first report of 18 cases treated with an extract derived from the spleen, marrow, brain, medulla, spinal cord, and thymus of rabbits immunized against the typhoid bacillus, later tests seem to have fully borne out his claims. Eichhorst has reported 12 cases, all of a severe type, treated successfully with the extract, all surviving and going on to perfect convalescence. The temperature reached normal in five to seven days following the injection. Two relapses also recovered under treatment by the extract. The fever seems to respond to its influence within twenty-four hours, and in forty-eight hours changes from continuous to intermittent, and by the end of the second week to apyrexia. Jez observed these results in every one of 50 cases.

With regard to preventive inoculations with sterilized cultures, it may be said that extensive experimentation has shown it to have a very decided value. An excellent opportunity has been afforded the English to test its worth in their armies in India and South Africa, and the results have been highly satisfactory when compared with cases that have lacked such protection. It has been by no means invariable in the immunity conferred; but when the inoculation has been carried out with fresh cultures, and repeated within a short time, it has exerted a marked protective influence. For a study of the subject we would refer to the writings of A. E. Wright, R. M. Cullman, Wright and Leishman, Parry, Parker, McLaughlin, Cayley, Foulerton, and Crombie. The solitary unfavorable criticism that has met our attention is that by Melville, who considers that more complications occur, the duration of the fever is longer, and the death-rate higher in the inoculated than in the uninoculated person. His assertions can hardly stand against the weight of evidence to the contrary.

Antityphoid serum, then, instead of discouraging by its gloomy outlook, as it has for so many years past, seems now to promise a signal help in the treatment of the disease. The typhoid infection is by nature a slow and gradually increasing one, and this fact, though it proved a hindrance in the discovery of a suitable and powerful antitoxin, proves to be a favorable factor now that we are in sight of a potent curative serum. We have taken little part on this side of the water in the development of the antityphoid serum, but there seems to be little doubt that the subject will now be taken up with a renewed energy and a thorough test given to claims that seem to be based upon clinical success.

ANTISTREPTOCOCCUS SERUM. Marmorek's antistreptococcus serum has been used extensively in certain directions during the period covered by the statistics of this paper, and in conditions suited to its use has met with marked success. Its proper use seems, however, to be a much more limited one than was at first supposed. Marmorek has from the first contended that streptococci, whatever their form or origin, produce the same toxin, which belongs to the group of diastases that succumb to a temperature of 70° C.; also, that the serum derived by immunizing animals against one form of streptococcus is effective against the toxin manufactured by all other varieties. The frequent failure of the serum to control the symptoms of infection by pyogenic organisms has not appeared to corroborate his finding, and it has been conclusively determined that when other micro-organisms than the streptococcus are involved in the process the specific serum exerts its influence upon the streptococcus infection alone. For these reasons very conflicting reports have been heard. Moreover, the serum has been used, as a rule, if not invariably, in critical cases; this fact alone would tend to militate against unvarying success with any remedy. With a view to surmounting one of these difficulties, Bokenham, Van de Velde, Denys, and others have endeavored to render the serum as polyvalent as possible by immunizing animals with as many different strains of streptococci as possible. Bokenham's clinical results have been most encouraging, and when the serum was fresh he obtained constant and decidedly favorable influence from the treatment. He found that the serum rapidly deteriorated, however, and that it was unfit for use after the third or fourth week.

We have found records of 117 cases treated during the last two years with antistreptococcus serum, and in 114 of these there was either a marked temporary improvement or a prompt recovery. The cases included puerperal septicæmia, erysipelas (mild and malignant), tuberculosis with pyogenic infection, general pyæmia, and local streptococcus infections, as well as a few cases of pernicious and simple anæmia that seemed decidedly improved by injections of the serum.

It will be remembered that in the report of the American Gynecological Association[1] 101 cases were reported as having been bacteriologically examined and the streptococcus found, and with a mortality under the serum treatment of 32.6 per cent. (33 deaths); also 251 cases in which no bacteriological examination was made, with a mortality of 15.85 per cent. (40 deaths), giving a total of 352 cases and 73 deaths —a mortality of 20.74 per cent. These findings resulted in the conclusion that the medical profession was not justified in proceeding further with the experimentation with the serum.

[1] American Journal of Obstetrics, May, 1898, No. 3, vol. xl.

Haberlin, however, treated 4 cases of general pyæmia (mostly puerperal) with the serum, and in the first case obtained a slight transient improvement; in the second there was no favorable result; in the third and fourth the morbid process was arrested as if by magic. Undoubtedly the difference in the strain of streptococcus involved produced the variance in results in such a series.

Harrison treated a malignant case of erysipelas with marked beneficial result and cure. Mitchell reports 1 case, seen in 1900, with symptoms that were growing steadily worse, but a prompt fall of temperature and general improvement followed the serum treatment. Shively reports a case of tuberculosis with mixed infection that showed marked improvement with Marmorek's serum; and Cahall, in the same journal, a case of gangrenous stomatitis, with immediate beneficial effect and cure.

Elder reports a case of pernicious anæmia, with an increase in the number of red corpuscles from 800,000 to 4,800,000. Injections of the serum were repeated every few days. De Witt cites a similar case, in which the number of the red corpuscles rose from less than 1,000,000 to 4,960,000, and the hæmoglobin from 30 to 90 per cent. in about three weeks' time. The latter used 8 c.c. of the serum every two to three days.

In addition to these cases, Schoull has in the last month reported three cases of smallpox greatly benefited by antistreptococcic serum.

Perhaps the most convincing series of cases is that of Tavel, also reported during the current year. Tavel takes occasion to emphasize the antibacterial influence of the serum, and states that in 76 cases of erysipelas, scleroderma, pneumonia, meningitis, streptomycosis in tuberculosis, phlegmon, perityphlitic abscess, etc., he has obtained positive improvement or recovery. In severe cases in which phagocytosis has already failed he obtained no result from the use of the serum.

All of these reports tend to convince us of the fact that antistreptococcus serum will at least do no harm, and that in cases in which the streptococcus is alone involved it will eliminate that micro-organism and control the symptoms caused by its toxin unless used too late for any remedy to be of avail. When the streptococcus infection is found in combination with those of other micro-organisms we have learned that the serum has no influence except in so far as it controls the streptococcus symptomatology. Undoubtedly the attempt to obtain a polyvalent serum is one in the right direction, and, as in typhoid fever, it presents a key to new accomplishments in the line of special serum therapy.

Antipneumococcic Serum. Although when first presented to the public in its two forms—the antitoxic serum of the Klemperer brothers and Washbourne and Pane's antibacterial sera—statistics seemed all in

favor of the new treatment of pneumonia, our estimate, after consulting the literature of two years, must be a very conservative one, and in the nature of a hopeful expectancy rather than a satisfaction over anything accomplished. De Renzi, Fanoni, and Pane have all had marked success with antipneumococcic serum, as indicated in their published case histories. All of Washbourne's published cases recovered, though without exception of a severe type. De Renzi's series included 29 recoveries and 3 deaths. A difficulty has seemed to consist in an inability to secure a highly immunized serum, and primarily in the difficulty of securing highly virulent cultures of the pneumococcus. As a result of this many reliable observers have failed to obtain the same successful results with the serum. At times, and in the hands of reliable men, we have seemed to have in our possession a serum that would answer all requirements, and again it has accomplished nothing; so that to-day no positive judgment can be registered with regard to the value of the serotherapy of pneumonia. Maragliano, Cantieri, and De Renzi appear to have had the most favorable results with the injections; but on our side of the water the experience has been often against and seldom strongly favorable.

Fanoni is one of the few who commend it highly, noting 18 cases in which the serum was used, with only one death, the latter patient being at the time of injection in the preagonal stage. He claims that in these cases the temperature was lowered and improvement was noted in the comfort of the patient; that all the symptoms were ameliorated and resolution hastened. Canby reports 3 cases of severe pneumonia in which the serum (Pane's) was used, and defervescence followed on the second day in 2 cases and on the fourth day in the third. Sears, however, publishes 12 cases treated with the serum and with other measures in conjunction, and with little benefit gained; 4 out of the 12 patients died, and the duration of the disease was about the same as in any series of cases in which the serum is not used. The patients gained greatly in bodily comfort, but the effect on the temperature was very variable. He states as his one practical objection to the treatment, our ignorance of the strength and potency of the serum at any given time, and concludes that his results warrant nothing more than a continuance of the trial.

Kelly and Musser have noted a case (an alcoholic) in whom the pneumonia followed a debauch. Large and frequent injections were made, each one producing a marked leucocytosis, though no other positive effect was observed. The serum supply gave out, and the patient went on to death, as he would in all likelihood have done in any event

De Lancey Rochester has reported a case treated with serum obtained from a blister produced upon another pneumonic patient, in which a marked beneficial result was obtained.

J. C. Wilson has published two series of cases—one of 18 and another of 17—from the study of which he simply concludes that a further trial of the serum is warranted. In the series of 17 cases there was a mortality of 35.3 per cent. He has also collected 162 cases from all sources treated with the serum, of which 27 had died (a mortality of 16.6 per cent.). His other series showed no marked favorable results. Of the 18 cases 4 died (22.2 per cent.). In 2 of the 4 no improvement followed the administration of the serum; in the other 2 there was slight improvement, but no permanent effect. At the same time in the Pennsylvania Hospital out of a series of 20 patients (all men, and 8 of these alcoholics) treated without serum only 4 died (mortality, 20 per cent.).

Elfstrom reports a series of experiments with a serum suggested by the Klemperers, which he obtained by applying two leeches to the forearm of a case of croupous pneumonia, and in 8 cases one leech. After squeezing the blood out of the leeches he diluted it with three to five parts of normal salt solution, and heated it to a temperature of 60° C. for two hours. The mixture was then decanted and injected subcutaneously; in the majority of his patients the temperature fell to nearly normal. They seemed able to leave the sick bed earlier than under ordinary treatment. In one case the patient died without any effect having been observed to follow the administration of the serum; in another there was no reaction. The quantity of blood used in the treatment seemed to have no effect upon its influence.

Perhaps the most recent report of any value is one by Eichberg, in which he cites 6 cases treated with the serum, with 1 death. His conclusions are that the serum will not precipitate the crisis, but will often diminish the severity of the disease. The fault that must be found with his series, as with so many others, is the limited number of cases on which the serum was tested. He notes, however, a fact that many others have also witnessed, and one that marks an important symptomatic effect of the serum, viz.: "In connection with the patients who recovered I would like to call attention to the almost complete cessation of cough and expectoration soon after the administration of the serum. The process of resolution in the consolidated area was accomplished apparently without any liquefaction, for no moist sounds were heard, though the consolidation was manifestly clearing."

This, then, is the most that we have been taught to expect from the use of antipneumonic serum during the past few years. Pane's series of cases, with a mortality of 9 per cent.; De Renzi's, of 32 cases, with a mortality of 9.3 per cent.; and Wiesbecker's, of 17 cases, all of which recovered, have not been duplicated with any such frequency as to warrant us in expecting such an outcome of the serum treatment of pneumonia. But we have the promise of much more positive results

as soon as we obtain more active sera and use them in large doses early in the disease, and that time does not seem to be necessarily in the distant future. The writers have known of a number of cases treated in Philadelphia with antipneumonic serum obtained from American sources, and with very varying results. In order to obtain any benefit large and frequent doses have been required, and there has always remained the question at the end whether the treatment has actually contributed to the result, if favorable, or, if adverse, has retarded the fatal process. In nearly all cases the patient experienced a very temporary relief from subjective symptoms.

ANTIPLAGUE SERUM. Antiplague serum seems to have yielded important and favorable results, although they have been little appreciated in this part of the world, because we have so far been so fortunate as to be spared the need of such a remedy. Following closely upon Haffkine's preventive inoculations with the vaccine, that reduced the percentage of cases to one-twentieth the number that occurred in the uninoculated, came Yersin's announcement that he had produced a curative serum. Calmette stated with regard to this, in 1899, that whereas the mortality before its use was 33 per cent., in 104 cases studied by him it was 13 per cent. as the result of the serum treatment. He repeated the injections until convalescence was thoroughly established, giving daily doses of 20 to 40 c.c. of serum, and sometimes as much as 320 c.c. in one day. In one case a drop of blood before inoculation gave thirty-two colonies of plague bacilli; after the injection it gave one to two colonies, and after the second injection the blood became sterile. In plague pneumonia he introduced the serum directly into the veins in doses of 20 c.c., and no case treated in this way was lost. In 1900 he writes again, emphasizing the value of the intravenous injection. He states that the plague bacilli multiply first in the lymph channels, but in a few hours are found in the blood and in the organs. The phagocytosis stimulated at once by the serum causes their prompt destruction. In this manner the serum has two distinct actions—curative and prophylactic. He obtains it by vaccinating small animals with virulent cultures killed by exposure for one hour to 70° C. The immunity is then increased by repeated injections of virulent cultures. In man phagocytosis begins at once upon the injection, and in a few hours the bacteria have disappeared. The temperature drops in from four to five hours, then often rises again for eight to twelve hours, and then falls finally at the beginning of an early convalescence. As a curative dose he injects 20 c.c. of the serum intravenously, and as a preventive 10 c.c. into the subcutaneous tissues.

Brownlee reports 9 cases treated with Yersin's serum, of which 5 recovered and 4 died. He admits, however, that his doses were too small, and states that at another opportunity he would employ 60 c.c

as his initial dose. Lustig and Galeotti claim for their own serum a much greater curative power than for that of others, and state that it is prepared by treating horses with a nucleoproteid obtained from dead plague bacilli. The rate of recovery in India, where the disease has been most virulent, and in an epidemic in which the general mortality was about 94 per cent., was about 53 per cent. under the serum treatment. Of 475 cases treated by themselves the mortality was only 39.36 per cent.

Choksey, a short time before, had reported 32 patients treated with Lustig's serum, in private practice, with a recovery rate of 59.37 per cent. He recommends the subcutaneous injection of 60 to 100 c.c. up to 150 to 300 c.c. or more.

Terni, who was commissioned by the Italian Government to study the plague in South America, found that Haffkine's vaccine (modified) gave the best means of immunization. He also produced a serum from cattle (beef) and monkeys, rejecting all animals that were not extremely resistant to the inoculation. This serum, he found, stimulated phagocytosis, and when combined with 0.5 per cent. sublimate solution, and injected intravenously, proved remarkably effective in the 4 cases in which it was used. The germs rapidly disappeared from the blood, and 3 patients as rapidly recovered; the fourth showed a marked improvement, and the treatment was stopped. This patient died, and at the autopsy a number of deep glands were found to have been infected from a primary bubo in the axilla.

Lucatello claims during the past year to have reduced the mortality of the plague at Florence to 46.15 per cent. of all cases treated. He also used Lustig's serum, which has been used extensively at Bombay.

Penna has recently treated 36 patients with the serum, with a mortality of 19.3 per cent., notwithstanding the fact that the supply of serum was scanty and the dose therefore small. The general mortality of cases treated at that time without the serum was 50 per cent.

Among the most recent reports are those of Jorge Pinto, from Brazil, and Proskouriakoff, from Bombay. The former reports only the results of preventive inoculations with Terni's vaccine, only 1 out of 1803 persons contracting the disease after exposure following "vaccination." In one district the only person who refused to be vaccinated took the disease. Proskouriakoff's letter from Bombay reports on the last very severe epidemic as follows: Between August, 1899, and March, 1900, 52 persons were treated with the serum, with 35 deaths (67.3 per cent.) and 17 recoveries. Of 162 cases not treated with serum 125 died (77.16 per cent.) and 37 recovered. During March, April, and May, 1901, 104 persons were treated with the serum, with 81 deaths (77.82 per cent.) and 21 recoveries. Of the foregoing the cases of a septicæmic type gave a mortality of 96.6 per cent., and those

of a non-septicæmic type one of 56.6 per cent. The septicæmic cases treated without serum gave a mortality of 98.1 per cent., and the non-septic cases one of 61.5 per cent.

These statistics give a fair idea of the influence of the serum treatment, and afford the opportunity to study the subject in a most satisfactory manner. Favorable reports have not been chosen nor unfavorable discarded; but as with the discussion of other sera, so here both favorable and adverse are cited when both are to be found. In virulent epidemics nothing seems to exert a very powerful action upon the disease, though even in severe cases the serum treatment has accomplished more than any other means. Preventive inoculations, however, have in places stamped out the scourge. In mild epidemics, on the contrary, the serum injections have had a marked influence, and their value now seems unquestioned.

A series of conflicting reports have come within the last few months from the commissions sent out from Russia, England, and Germany that leave the question in a less satisfactory position than before. The British Commission examined samples of Yersin's as well as Lustig's sera, and stated that they could find no specific antibacterial substance in them; that plague bacteria grew in them luxuriantly. On inoculating guinea-pigs with the bacillus pestis and then treating with Lustig's serum the latter seemed to hasten death. Yersin's serum seemed to delay, but not to prevent death. Yersin's serum was used in the South Camp Hospital, at Bungalore, on 49 cases, the mortality in the North Camp Hospital serving as a control. In Bombay, also, 28 cases were treated with the serum. In both Bungalore and Bombay the advantage in favor of the serum treatment was very slight, the case mortality showing a diminution of 4 to 5 per cent. Life was not prolonged, nor convalescence accelerated, nor was there any well-marked alleviation of symptoms.

Captain Mason, however, treated 100 cases with Yersin's serum, with a mortality of 59 per cent. A series of 100 control cases showed a mortality of 83 per cent.; but most of the serum cases were during a declining epidemic, while the control cases occurred in the full height of an epidemic.

Dr. Simond used Yersin's serum in 300 cases at Karad, etc., with a mortality of 58 per cent.; the mean mortality in the same hospital in cases treated without the serum was 75 per cent. Choksey tested the serum on three series of cases: (1) On 257 serum cases the mortality was 22.7 per cent. less than in 752 other hospital cases, including the untreated, moribunds, etc., which were not included in the serum count; (2) on 403 serum cases, which gave a diminution in the mortality of 18.7 per cent. as compared with 1190 patients not treated with the serum during the same period; and (3) on 968 patients (using the

alternate system), the difference in percentage mortality being 11.5 per cent. in favor of the serum group. On subtracting the convalescents and moribund from both groups this difference became 20 per cent.

These results appear to the impartial observer to indicate a value accruing to the credit of the serum treatment that ought to be apparent to anyone in spite of the isolated negative animal experiments; and it is worthy of notice that Dr. Galleotti, who made inoculation experiments at the same time as the British Commission, saved 6 out of 8 animals (infected with plague) with Lustig's serum; and yet the German Commission concludes that the only verdict that can be given is "that the injections of serum have had no perceptible, immediate, or remote harmful results."

The Russian Commission states that the serum is an "absolutely indifferent substance, with no influence either for good or evil on the course of acute plague."

And, finally, the British Commission finds that Yersin's serum as received from Paris contains "therapeutically useful substances in greater or smaller quantity"—a none too definite statement, to be sure.

The reports from individual observers certainly indicate a positive value in the serum treatment when properly employed. The question of the extent of that value is, however, still an unsettled one, and no further statement can be made from the information at hand. Study is by no means relinquished, and it is still possible that a serum will yet be obtained of greater curative powers than that which is at present in use.

Antitubercle Serum. The onus of the labor involved in the production and introduction of an antitubercle serum has been borne in great part by two men—Fisch, in this country, and Maragliano, in Italy. Both inject animals with tuberculin—the former horses and the latter asses—with a view to producing a true antitoxic serum, as in diphtheria. Courmont's and Arloing's recent papers have indicated that a serum produced in this manner has also an antimicrobic power, though this is not believed to be the case by its originators. There seems to be no doubt that in tuberculosis the subject dies more often as the result of a mixed infection than owing to the single influence of the tubercular toxin. Against such mixed infections the serum has never had any effect either in laboratory animals or in human beings; but where the case has seemed to be one of pure tuberculosis, and especially in its early stages, certain observers have apparently obtained beneficial results that at least warrant our attention.

As early as 1899 Holmes reported, after sixteen months' study of the results of serum treatment, that "it is the coming therapy for tuberculosis." He later reports 50 cases treated over a period of twenty-one months, with most encouraging results. Ambler reports

in the same year 100 cases, in treating which he used Fisch's antitubercular serum (Tr). He began with an injection of 0.2 c.c., and gradually increased the dose to 1 c.c. and even 2 c.c. His results were as follows:

Apparently cured	41 cases.	Stationary	11 cases.
Much improved	31 "	Died	2 "
Improved	14 "		

Stubbert had in 1898 reported 36 cases of incipient tuberculosis of the lungs treated with the serum in addition to general hygienic measures; 14 of these were apparently cured. In 1900 he reports that of the 14, 9 are still apparently well (no cough, no physical signs, able to work). He also reports 13 additional cases that have been out of the institution about a year, all showing constant and marked improvement. His summary states that of the patients leaving the institute three years ago 11 per cent. have remained cured; two years ago, 14 per cent.; and one year ago, 69 per cent. He looks upon the serum treatment as a valuable aid to other measures.

Numerous tests have been made upon persons in good health by Roncagliolo that show a marked natural defensive power against the toxins of tuberculosis (averaging from 1000 to 4000 antitoxin units). He found that this quality attained its highest intensity in alcoholics, reaching 10,000 units in one man, aged fifty-two years, a chronic alcoholic, with chronic pachymeningitis. He found, however, that the antitoxic power of the individual diminished decidedly with defective nourishment and debility. Repeated injections of Maragliano's serum in small quantities raised the normal immunity in a month or two to 10,000 units per cubic centimetre—a far higher point than could be accounted for by the serum therapy. This discovery is important as showing the tendency under serum treatment, and will lend encouragement to those who are watching the clinical side of the subject.

After three years' trial Fanoni believes that the serum treatment of tuberculosis is the only scientific antituberculous treatment employed to-day. In cases in which there was no mixed infection he has seen it give valuable help in the treatment.

Mircoli publishes the statistics of 2889 tuberculous patients treated with antitubercular serum, as follows:

Cases of apyretic patients		250
Cured	95	
Improved	110	
Stationary	30	
Worse	35	
Cases of febrile patients with circumscribed lesions		938
Cured	168	
Improved	511	
Stationary	163	
Worse	96	

Cases of diffuse tuberculous bronchopulmonitis (microbic association)		332
Cured	31	
Improved	142	
Stationary	98	
Worse	61	
Cases of diffuse tuberculosis without microbic association		665
Cured	91	
Improved	301	
Stationary	166	
Worse	106	

Maragliano publishes his results for the period 1900–1901, under treatment with his own antitoxin, and obtains the following figures: In the year closing with June, 1901, 130 out-patients were treated and 36 clinically cured (including 17 with fever and destructive processes, and cavity formation in 3). Improvement was noted in 58, in 31 the condition remained stationary, and in 5 the disease progressed. He states, however, that it is impossible to cure without re-enforcing the strength of the organism.

Fraenkel and Bronstein conclude as the result of their studies (1901) that: (1) Cultures of tubercle bacilli can be made to yield a tubercular toxin, the aqueous tuberculin, the bacilli digressati (the bacilli from which all fatty substances have been removed), and other derivatives; (2) the greater number of these substances possess a marked toxic power, that can be gauged by dosage; (3) these toxins when injected cause death, with the characteristic lesions; (4) by means of small and then increasing doses (up to the maximum) it is possible to render immune the animal experimented upon; (5) the serum of immune animals possesses a strong antitoxic action against all of the toxic substances.

Finally, Cioffi, during the present year, reports his experiments upon a large number of guinea-pigs, which were first inoculated with tuberculosis and then treated with Maragliano's antitubercular serum. None of the animals thus treated died. He then reports several cases of human beings with tuberculosis, who were also treated with the serum. All had distinct tuberculous lesions, and improved so far as to appear cured. He considers that the serum treatment is contraindicated in any condition other than tuberculosis.

Clinical and experimental evidence would then appear to show that in the serum treatment we may have an adjuvant in the control of tuberculosis which, if used early, may alone result in cure, and even when used late may tend to retard the process and promote healing. As often as the test has been made the value of the serum has been witnessed, and it is to be hoped that the next few years may make still more certain its curative value, may indicate more definitely the cases that can be benefited, and may enable it to be produced at a cost that will render it available for the poorest tuberculous subject on the globe.

ANTIVENENE. The last serum of which we shall speak at any length is that which was finally secured by Calmette after numerous preliminary experiments by Wolfenden, and Physalix and Bertrand, who first demonstrated the fact that a protective principle was formed in the blood. We will simply say that the studies of Calmette, Martin, and later of McFarland (upon crotalus poison), have shown that against cobra poisoning antivenene has a very powerful action, and against other venoms a much less active one. This statement is borne out not only by the laboratory, but by actual clinical tests; and illustrative cases have been reported by Rennie and Beveridge, in both of which recovery from snakebite followed treatment by Calmette's antivenene. The former's case was a boy, aged twelve years, who was bitten in the finger. Recovery followed in five days. Hanna reports a recent case of cobra poisoning treated in the same manner. The assistant was bitten in the thumb in attempting to extract the venom from the snake. The wound was sucked at once, and within twenty to thirty minutes 18 c.c. of antivenene was injected. Symptoms of slight stupor, nausea, and vomiting followed, with slight paresis of the legs; there was then a complete though gradual disappearance of all symptoms. Other cases have appeared scattered throughout the literature, and all tend to verify the findings of Calmette as limited by other writers. It seems settled that antivenene is of decided use in all cases of snakebite, but that its use is far less potent against the rattlesnake and similar viper poisons than against that of the cobra; in short, that its action is directed against the nervous rather than the irritative and tissue-destroying principle in the venom. Whatever the form of venom, antivenene should be used at once (20 to 40 c.c.) after the bite, and repeatedly; all possible venom should be sucked from the wound, and, as McFarland suggests, an aqueous solution of calcium chloride should be injected around the wound itself. It is hardly necessary to state that a ligature should be thrown around the limb at once, so as to shut off the poison as far as possible from the general circulation.

Dyer first, in 1897, and Woodson again, in 1899, have used Calmette's antivenene with remarkable results in cases of undoubted leprosy, and report cures after other treatment had failed completely and the case seemed to be going from bad to worse.

MISCELLANEOUS. We have now covered, at somewhat greater length than was intended when this article was planned, a sketch of the progress of serum therapy in so far as it has accomplished positive and promising results. There still remain a considerable number of antitoxins, or attempts at the cultivation of immune sera, that have not as yet established themselves as curative measures deserving of confidence. Pfeiffer's *anticholera* serum has a marked antitoxic action in the laboratory, but it has not met with the enthusiastic success clini-

cally that was promised. As a prophylactic it has been of great value, but as a curative measure it has failed; yet Tretrop studied the epidemics of 1892–94, in which the annual percentage of recoveries varied between 44 and 62 per cent., and claims that the benefits of the serum treatment were markedly evident in cases in which it was the only treatment employed.

Shiga has prepared a serum to combat the form of *dysentery* due to his bacillus. After securing a high degree of immunization in the horse or ass the serum is withdrawn three weeks after the last injection of agar cultures of the bacillus; to this serum carbolic acid is added in the proportion of 5 per cent. In mild cases he injects 5 to 10 c.c., and 15 to 20 c.c. in those of a severe type. The results of serum medication he claims to be far in advance of those of other methods of treatment. Even in the most favorable results of the ordinary treatment the death-rate is twice that obtained by serum therapy. He notes as an interesting fact that among 40 patients 15 had an eruption around the seat of inoculation (37 per cent.), 1 had an eruption over the entire body, 2 had joint pains, and in the remainder there were no symptoms attributable to the serum. Eldridge notes Shiga's results up to November 1, 1899, as follows: In the Laboratory Hospital, in 1898, 65 cases were treated, with 9 per cent. fatality; in 1899, 91 cases, with a fatality of 8 per cent. In the Hirowo Hospital, 110 cases, with 12 per cent. fatality. During the same period in 1899, and under the ordinary treatment without serum (in Tokyo) in the Hiujo Hospital, 166 cases and 37.9 per cent. mortality; in the Hirowo Hospital, 53 cases and 37.7 per cent. mortality; in the Komagoma Hospital, 398 cases and 34.7 per cent. mortality; and in private houses 1119 cases and 28.5 per cent. mortality. The expense of the treatment is a great drawback.

Terni has endeavored to use a serum obtained by immunizing dogs and rabbits to the bacillus icteroides in the treatment of *yellow fever*. Agramonte, on the other hand, has used the blood serum of convalescents from yellow fever, and of 5 cases observed 4 convalesced promptly. In none of the cases so treated was the hemorrhagic form of the disease seen. He does not believe that the bacillus icteroides is the cause of yellow fever, and mentions the fact that it neither agglutinates with any regularity with serum from yellow fever subjects nor does their serum protect guinea-pigs inoculated with the bacillus icteroides. Sanarelli's serum depends also upon the identity of the bacillus icteroides with the cause of yellow fever, and has shown little clinical value. All recent investigations seem to indicate that Sanarelli's bacillus is identical with the bacillus of hog cholera, and if this be true it is not difficult to account for the failure of its immune serum to act against the toxin of yellow fever.

Weisbecker, in 1897, claimed that treatment with the serum from *scarlatinal* patients produced an amelioration of the symptoms of the same disease. Since that time von Leyden, Huber, Blumenthal, and others have confirmed his statements by studies of their own. Von Leyden notes 16 cases treated in this way, in 3 of which the result was brilliant and in the remainder less positive. In general the course of the disease was shortened. In the beginning 10 c.c. of the serum was used, later 12 c.c., and finally 20 c.c.

Liscia reports two recent cases of *anthrax* infection in the human being, both of an unmistakably malignant variety. Both were saved by the prompt use of Sclavo's antianthrax serum. In many years' experience Liscia notes that all of the mild cases have recovered and all malignant types have died, no matter what treatment was employed, until he obtained this positive result from serotherapy. Dasso reports 130 cases treated with the serum, and as a constant result a falling temperature, disappearance of the œdema, general improvement, and resolution of the ganglionary infarct. Only 9 of the patients died, and all of these from secondary infection. The remainder of the series testified to the efficacy of Mendez's serum. Dasso used 10 c.c. subcutaneously, and states that Mendez's serum is much more powerful than Slavo's or Sabernheim's product. Mancini has reported within the last three months a case cured by injections of Sclavo's serum. He asserts that in adynamic cases the fever rises as an expression of the exertions of the organism. In dynamic subjects the fever falls at once as an immediate effect.

Carasquilla showed in 1900 that the bacillus lepra could be cultivated upon blood serum (Hermann's method), and also that by manipulation the bacillus could be rendered aerobic and motile, and that secondary cultures could be made. He then produced an immune serum, which he has since employed in the treatment of *leprosy*. After noting the good results obtained with the serum by Catasquilla and Laverde, W. A. Lee reports that he has been especially successful with it in malignant cases with fresh nodular eruptions in luxuriant growth, and in the presence of fever (102° to 104° F.). Two such cases were treated by him at the Government Hospital in Madras, each being injected with a vial of Carasquilla's serum (9 c.c.). The fever quickly abated, and the tubercular infiltration in the more severe case rapidly disappeared, leaving the skin shrunken and flabby. This patient has improved continuously since. In the milder case the changes were less notable, though the improvement was also observed. In an experiment made with Haffkine's prophylactic serum on a nodular leper child the usual reaction followed, and no fresh tubercles have appeared for nearly two years.

A few isolated cases of *glanders* have been reported as treated with

immune serum, and among them one of A. Dupuy, who notes that recovery followed a severe attack.

Jez has employed the serum of a patient with *erysipelas* upon others suffering from the same disease. He notes 10 cases in which he observed a rise of temperature after one to two hours, and a rapid improvement in all the symptoms. The number of leucocytes rose and the toxicity of the urine markedly increased. He used 5 to 10 grammes at a dose, at times increasing this amount. The serum was obtained from a blister artificially produced for the purpose.

Sylvestri drew 120 c.c. of blood from the arms of two children recovering from *whooping-cough*. This he mixed with equal parts of saline solution, and then shook it with 1 per cent. of chloroform, setting it aside for twenty-four hours. It was then filtered and 15 to 22 c.c. injected into five other children with whooping-cough. In two very severe cases the injection was repeated in five days. The effect of the serum treatment was evident at once. The general symptoms rapidly disappeared, and the cough and bronchopneumonic phenomena were completely gone in eight to eleven days.

Moore has during the last seven years been testing and experimenting with the serum from *syphilitics* as a cure for that disease. It has never failed to arrest the symptoms, and has proved in his hands a valuable differential measure for chancre. Its local application produced a marked change in a day or two, with cicatrization in a week. It had, moreover, no effect upon soft chancre. He obtains the serum by blistering syphilitics, and injects 10 to 40 c.c. of this serum every third or fourth day. He has now tested its worth on 75 cases, 30 of which he describes at length in his article. Neviorovsky has also studied the effect of serum taken from patients with tertiary lesions of syphilis, and has noted a rapid disappearance of subjective symptoms in certain cases. In control cases injected with the blood of healthy individuals no effect was produced.

No serum treatment has as yet been developed for *malaria*, and Celli goes so far as to say that it is impossible to immunize human beings against the disease by means of the blood and tissue juices of animals that are immune. Even quinine was ineffectual in protecting against experimental malaria. Experiment has not been relinquished, however, and it is hoped that malaria, too, will give way to intracellular immunization.

There remains neither time nor space to discuss Trunecek's artificial (inorganic) serum for arterio-sclerosis, so favorably commented upon by Levi and others; or Hayem's artificial syphilitic serum, commended by Augagneur and others; or Coley's tumor serum, recently revived by George, Jr. Even vaccination and rabies must be passed by on the ground that the processes involved in these conditions are not strictly

included under our title. Inspection of the report of the work of the Pasteur Institute in 1900, published in June last, will repay the student who consults it for interest and information.[1]

In closing we would simply refer to the preparation by R. Emmerich and O. Löw of a product named by them the "immunizing and curative proteidin." They have cultured bacteria on a large scale on suitable media or in the animal organism, and collected the specific bacteriolytic enzyme produced. Combinations of this enzyme with the albumins of the blood, they claim, furnish the only truly specific immunizing and curative substance. They have manufactured this on a large scale, and have used it in anthrax and hog cholera, and state that the results obtained warrant the belief that it will supplant what is now known as serum therapy. The medium used by them consisted of

Asparagin	0.8	NaCl	3
Pepton. sicc. . . .	10	Bouillon	100
Potass. biphosph. . .	2	Aq. dest.	1000
$MgSO_4$	0.15		

Cultures are sown in this (altered slightly for various forms of bacteria) and placed in large vessels for four to five weeks; it is then filtered through a Berkefeld filter. Albumin is added in the form of fresh beef blood or ground spleen, etc. The finished "immune proteidin" is then precipitated with alcohol and made into a powder. No comment can, of course, be made at this time upon the value of the product.

While the writers have included in this paper many cases and clinical data that might easily have been omitted, they have preferred to allow the individual to form his own opinion of the various divisions of serotherapy from the reports of their actual use; and this rather than from conclusions based upon our own view and interpretation of the same. It must be remembered, and we have already stated the fact at more than one point in our discussion, that statistics such as the foregoing present one never-failing source of error, viz., the tendency to report favorable cases and to withhold the unfavorable examples of a certain form of treatment. If, then, an estimate be formed of one or another branch of serum therapy that would seem at all in favor of its efficacy, it will be well if the fact be realized that statistics are of themselves poor guides to a correct conclusion. We find the outlook of serum therapy an encouraging one, but we do not wish to seem enthusiastic prior to a thorough test of figures and actual results. It is only in this way, moreover, that those who have not at their command all the facilities for experiment can learn of the work of those more fortunately situated

[1] Viala. Annales de l'Institut Pasteur, June, 1901.

for the study of methods that will perhaps lighten their own load as well as bring comfort and health at critical times to their patients; and it is with the hope that as great a development will be witnessed in serum treatment in the next few years as in the period just covered that we conclude our study of the newest therapeutic science.

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SOME OBSERVATIONS UPON DELUSIONS, IMPULSIVE INSANITY, AND MORAL IDIOCY.

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MEDICINE and law developed in systematic effort to preserve and benefit society without doubt accomplish much good in their respective spheres; but men who have witnessed and pondered upon the efforts of these sciences to solve together problems which arise from unlawful acts committed by the alleged insane soon note unsatisfactory procedure and result. We see, upon one hand, persons mentally alienated bespoken sane by juries within régime of the law, and, upon the other, both court and jury listening with questioning credence to

medical testimony concerning various insane states. These and other unsatisfactory conditions are largely due to lack of knowledge on the part of the court, medical witness, and counsel, respectively, of the varying viewpoints other than his own, which are occupied in reference to insanity and also to inadequate information concerning the developmental phases of legal and medical science which have led up to these positions. Obviously, complete co-operation among all the factors engaged in administration of justice is desirable, for it may be said, for instance, that a jury without medical exposition, will perhaps never see the necessity for immediate detention of the author of those facetious and seemingly shrewd tricks, frequently perpetrated by incipient progressive paralytics or those to be noted in the maniacal state of circular insanity. But as against this we may also hope that greater weight will be accorded testimony that recommends restraint in such cases when the medical expert who deposes will not advocate, or seem to, entire criminal immunity for every person in the least degree mentally alienated. With the intent to contribute something toward a better understanding that is needful between court, counsel, and testifying physician, and, through the harmonious efforts of these judicial elements, toward acquirement of greater confidence on the part of the lay public, in our profession upon the stand, this essay will consider some facts pertaining to mental conditions which are frequently propounded as the cause of homicide or other grave unlawful act.

"*A delusion* is a false perception accepted as a fact. It may be based upon an illusion or an hallucination. It may also result from reasoning in regard to real occurrences, or be evolved out of the intellect spontaneously as a result of imperfect information, or be an inability to weigh evidence or to discriminate between the true and the false. A delusion to be an indication of the existence of insanity must relate to a matter of fact; must be a belief that would not be entertained in the ordinary normal condition of the individual; must have been formed without such evidence as would have been necessary to convince in health, and must be held against such positive testimony as would in health have sufficed for its eradication."[1]

Because judgment for or against commitment for insanity is pronounced by laymen, a fact known to students of psychiatry should be more commonly understood, viz., that delusions, although the frequent manifestation of lunacy, are not always evidence of it. For a clear comprehension of this statement let us take note of some frequent and ordinary delusions and also some historical false ideas.

First, as regards classification. It is convenient to follow Esquirol,

[1] William A. Hammond. "A Treatise on Insanity."

and set down as Class A delusions which are based upon an illusion, namely, an actual sensory perception falsely interpreted; as Class B hallucinatory delusions—that is, such as are not based upon an immediate sensory perception of the outer world. Convenience dictates the use of this classification, because, although of great practical service in the many instances in which it is applicable, this differentiation is nevertheless established in some cases with great difficulty or is altogether impossible. An illusion refers to individual experience; hence our ability to decide upon it as the basis of a delusion in another depends upon the knowledge gained from our own senses. Thus a person who, under ordinary conditions, mistakes the identity of one person for another, or who hears spoken messages in the sound of bells, possesses a delusion clearly based upon an illusion; but if this same spoken message—claimed to be heard at a time when to others there was no audible sound, and therefore to be regarded as an hallucination—in reality originated in certain very common head noises which are alone audible to the person experiencing them, as for instance, rhythmical sounds arising in the cranial circulation or the tinnitus aurium due to middle-ear catarrh, we would after all, in such a case, have to do with a misinterpreted sense-perception—an illusion appearing as an hallucination to all others than the subject of it.

Nevertheless, despite possible difficulty in assigning the exact origin of false ideas in exceptional cases, many at once betray their true character. For example, we pronounce without difficulty as insane a belief wherein a man declares that he is some renowned character in history whom we know to be dead, or that he is the Supreme Ruler of the universe. He may thus express in one idea or another this same kind of false belief, viz., that which exhibits an insanely exaggerated self-importance. Another class of insane delusions typify persecution. A person may entertain the belief that, although innocent of crime, he is being tracked by the police, or is being slowly poisoned for his wealth, or because he is looked upon as an obstacle in a supposed love affair, etc. Insanity is also often betrayed by somatic delusions, such as the belief that the body is made of glass, necessitating the greatest care in moving about; that only the talking head lives, and that all the rest of the body is dead; that moving machinery is in the abdomen, etc. These corporeal beliefs are usually illusions depending upon some pathological body function. Paraplegia or mere skin anæsthesia may easily suggest death of a body-part to the insane mind; an increased and perceptible peristalsis of the bowel as easily machinery in the abdomen.

If we reflect upon the means which enable us to deny the truth of these ideas we find (1) that the refuting testimony is furnished by our senses employed at close range, and that the evidence is probably

corroborated by several of them; (2) that our decisions refer to a combination of facts concerning which we ourselves and others have deliberated upon and reached similar conclusions many times previously to each particular instance—*i. e.*, they refer to common experience. All insane delusions, whatever their origin, involve "inability to discriminate between the true and the false," and are therefore not corrected. Hence an uncorrected delusion is usually deemed equivalent to an insane one. This test is applicable in many cases, but cannot be invariably relied upon. To illustrate, we shall designate as Class 1 all insane delusions, and some already cited may serve as examples. Class 2 shall include delusions of sane persons, and in reference to these we shall now speak.

The story in the school books relating how the guide-post in an imperfect light assumed a human shape—a delusion dispelled by closer inspection—portrays a false belief of sanity based upon an illusion. But sane persons also at times experience and correct hallucinations. Well known is Goethe's approaching vision of himself. He relates concerning this adventure upon the road to Sesenheim: "I saw, not with the eyes of the body, but of the spirit, myself upon a horse, approaching on the way, and, in fact, in a garb which I have never worn; it was light gray and gold. As soon as I shook myself out of this dream the figure disappeared." Dornbluth[1] regards this vision as identical with the imaginative faculty of great artists to vividly reproduce pictorial or acoustic impressions. The connection is scarcely apparent at once, but becomes plainer in the light of Goethe's claim that he could give form to images passing in his mind and the possibility that he had pictured such a scene to himself. The idea of a man meeting himself is not novel. It has more than once been employed in romantic fiction. Medical history records many other well-authenticated hallucinations of persons whom society would hold accountable for their acts. Nicolai, a German bookseller, in 1790, for many weeks, during which he attended to his affairs, saw during day and night numerous figures of persons—some on horseback—also forms of dogs and birds, that he knew existed only as hallucinations. After four weeks he could hear some of the phantasms talk. His hallucinations disappeared after the application of leeches to the arms.[2]

[1] Compendium der Psychiatrie.

[2] Hammond. Loc. cit. As proven by experience, the correction of persisting and oft-repeated hallucinations cannot be continued indefinitely. Gradually the intellect will accept them as realities. This the experience of the painter Blake demonstrates. The latter required but a single sitting to afterward see at will the material figure of his sitter as the latter had appeared, which was accomplished by looking at the chair which the subject of his work had occupied. This faculty was a great help to the artist in the dispatch of his work, but gradually the painter lost the distinction between the imaginary and the real figure, and later mental confusion, loss of memory, and insanity followed.

In recent times the London Society of Psychical Research has recorded numerous instances wherein persons deemed mentally responsible recounted the appearance of apparitions as within their experience. According to present common knowledge, we cannot do otherwise than classify such occurrences with ocular hallucinations, and, as in the instances of delusions of sane persons previously cited, demand (1) that interpretation must place such visions outside a normal manifestation of the physical world; (2) the person to whom the hallucination appears must not be so influenced thereby that his actions be other than the possible outcome of common world experiences.

Thus far we have briefly considered some uncorrected insane delusions and also some examples of corrected false ideas of sane persons. We may next examine some uncorrected delusions of the sane.

It is readily seen that a mistake, in its limited sense of a misconception, and a delusion (previously defined as acceptance of a false belief as a fact) have a common origin; both are misinterpretations of or a false conclusion deduced from sense perception. But while human fallibility is an axiom, and looked upon with indulgence because universal, an individual may not leave his delusions uncorrected with impunity, because concerning them there exists a different unanimous opinion. The latter is the result of more exact knowledge (in fact or so supposed) than is the basis of a mistake, inasmuch as the source of information is furnished by common experience or is the product of science as interpreted by a comparatively limited number of persons, whose opinion concerning a given subject is accepted as a demonstrated fact by the majority of people, although unproven by the latter.

This condition obtains because the designated minority is believed to be more conversant with all the facts established in relation to a given subject. It is no arraignment of science, but mere testimony to its striving upon planes higher than are those of common experience, to recognize that its dicta from time to time must be corrected, and to comprehend that supposed facts accepted as truth up to a certain time are eventually proven to be delusions. Of the latter, one often cited was the belief in witchcraft. Perhaps at first glance it may seem unreasonable to categorize the demonology of a previous age with twentieth century science, yet both stand in their time for the most advanced explanation by learned men of physical phenomena. Maudsley,[1] himself quoting, says: "The most learned physicians only put the devil a step farther back, acknowledging 'such a preparation and disposition of the body through distempers of humors which giveth great advantage to the devil to work upon, which distemper

[1] Responsibility in Mental Disease, foot-note, p. 10.

being cured by physical drugs and potions, the devil is driven away and hath no more power over the same bodies.' "[1]

About two hundred years ago Lord Hale, instructing a jury, stated that he made no doubt at all there were such creatures as witches: "For, first, the Scriptures have affirmed as much; secondly, the wisdom of all nations had provided laws against such persons, which is an argument of their confidence of such crime (*i. e.*, witchcraft)."[2] This utterance of an eminent jurist unquestionably emanated from a sane man—a circumstance of special interest to us, as it was pronounced at a time when the belief in witchcraft was no longer universal; therefore, delusion concerning power to bewitch, being at that period corrected by some and uncorrected by other sane persons, it is clear that at the close of the seventeenth century this false belief could not properly have been looked upon as an insane one. In our time, however, to pronounce the death penalty because of a faculty to bewitch evilly would no doubt lead to inquiry as to the court's sanity; and, moreover, particularly in view of the many judicial errors of like nature at a later date in our own country, we note how recent is the necessity to correct a delusion the belief in which may not to-day be reflected in the actions of sane persons. But if we recognize in the error of belief just considered one which is always evolved at some period of a people's mental development in the effort to explain unknown causes of world phenomena—one, also, which thrives best upon the very absence of accurate testimony, except in so far as the marvel of co-ordinated muscle spasm and catalepsy had arbitrarily been adduced as proof—how was it in regard to the belief that the earth and not the sun was the centre of our solar system? Galileo had proclaimed the truth of the Copernican system, yet in his old age and under humiliating circumstances was made to recant and to publicly announce his adherence to the older theory. In this one may perhaps see mere evidence of Church power which scented danger in the rejection of any established doctrine. But also important is the fact that the delusion concerning movements of the earth and heavenly bodies was seemingly proven by calculations accepted as correct by learned men of that day. True, some phases of our solar system were not in exact accordance; but in this day, with immeasurably more exact data, a like condition prevails in so far as known astronomical laws do not explain all celestial phenomena. Referring to the explanation of physical laws by modern science, the writer knows of an obscure,

[1] The modern physician will not fail to recognize in the above correct clinical observation of disease, if he only substitute the present day theory of locus minoris resistentiæ for "distempers and humors" and pathological bacteria or any morbid process of disease for Satan himself.

[2] Maudsley. Loc. cit.

mistaken, but in any case sane philosopher who rests satisfied that Newton's theories concerning gravitation contain egregious error, and that they do not take cognizance of certain existing conditions. This person's ideas are fallacious; nevertheless, we have a sane man who fails to correct his delusion, and in this his position is the same as Galileo's appeared to opposing scientists of his day. And in our own day who will question the sanity of ex-President Kruger, who, on good authority, is said to declare his belief that, barring slight inequalities, the surface of the earth is flat? We remember, too, that child-life is filled with delusions. The babe reaches for the moon; night-terrors of children are peopled with ocular hallucinations; the young arrive at most unreasonable conclusions as to the acts and motives of persons about them. Such false beliefs are in general not viewed with alarm, because, in respect to the child, a normal judgment is usually attained with added experience; and in respect to society we recognize in childhood a receptive age, and not one that, as a rule, acts upon its own judgment to avenge fancied wrongs. So, also, with the adult who does not act in accordance with peculiar beliefs. For him much latitude of individual opinion is countenanced, and, therefore, so long as an individual's delusions appear harmless—that is, effect no relaxation upon his part of his obligations to society and to himself as a part of it—we are content to regard him as an eccentric, meanwhile suspending judgment as to actual mental status.

With this brief résumé of mind-conditions relating to delusions we pass on to succeeding topics, enough having probably been said to have made clear why this variety of false idea and the state of insanity are by no means equivalent to one another; and no less patent will appear the reason for the alienist's desire to base his pronouncement as to sanity in a given case upon the individual's demeanor and conduct in its entirety, or, in other words, upon the latter's *collective reaction to life's stimuli* rather than upon expression of any single delusion, however bizarre.

Impulsive insanity shall include those forms of degeneration insanity wherein the subject is possessed of morbid propensities and impulses, and wherein, if the latter be consummated by action, the same is undertaken without a clear motive, but because an irresistible impulse so to act is experienced.

Moral insanity, a form of imbecility characterized by the absence or enfeeblement of those emotions which combat the inconsiderate gratification of egotism.[1]

[1] These definitions are practically identical to those laid down by Kraepelin. Psychiatrie, Emil Kraepelin, 1896.

When and where both the law and medical science, emerging from mediæval intellectual darkness, threw off the incubus of demoniacal possession as the explanation of mental alienation, these recognized but two kinds of acquired insanity, viz., *mania*, in the sense of maniacal fury, and *melancholia*, including under this head all lunacy not congenital and not characterized by raving paroxysms. Because of frequently associated mental depression in cases of chronic insanity, melancholia came to have its present significance; but, as pointed out by Prichard, this term, from the Greek, was originally synonymous with insanity, literally meaning to be out of one's mind. Experience demonstrated, however, that some deranged persons exhibited a mood the reverse of melancholy, these being eager in the enunciation of certain delusional opinions, and yet, far from being actuated by blind frenzy, were collected and apparently rational upon some or most subjects. Such conditions first received extended and formal recognition in psychiatric classifications so late as the early years of the nineteenth century under the title *monomanie* (Esquirol, 1772–1840), although the literature records clinical descriptions of like cases by earlier observers (Plater, Ettmuller, Pinel). Long before Esquirol's time, however, Lord Hale (1609–1676), by differentiating between a partial and a total insanity, practical established legal recognition of mental disease marked by conduct influenced by delusions to greater irrationality in some respects than in others.[1]

The foregoing types of mental alienation—viz., mania, melancholia, and monomania—served as a basis upon which were constructed many classifications of insanity, as, for instance, one *according to cause* (Morel), which, however, to some extent, merely represented a clinical picture instead of etiology, viz., climacteric insanity, phthisical insanity, mania of pregnancy, of lactation, etc.; *according to functions interfered with* (Bucknil), *faculties affected* (Maudsley), *by symptoms* (Griessinger), *upon clinical history* (Clouston), etc. The foregoing and all other classifications of abnormal mental conditions remain very imperfect to this day, because as yet we lack that knowledge of minute pathology

[1] He said: "There is a partial insanity and a total insanity. The former is either in respect to things *quoad hoc vel illud insanire*—some persons that have a competent use of reason in respect of some subjects are yet under a particular dementia in respect of some particular discourses, subjects, applications, or else it is partial in respect of degrees, and this is the condition of very many, especially melancholy persons, who for the most part discern this defect in excessive fears and griefs and yet are not wholly destitute of the use of reason." (Maudsley, loc. cit.) Lord Hale apparently speaks with special reference to melancholia wherein this partial insanity was most patent. At the same time, we need remember that the term *melancholia* as used two hundred years ago conveyed a somewhat different meaning than it does to the alienist of to-day. Modern knowledge of insanity breaks down in many instances the old rigid limits which separated melancholic from maniacal states, since it is known that both conditions are often comprehended within a single disease—witness such transitions of mood in periodic and circular insanity, or again in melancholia agitata, where the listless demeanor common to depressed mental conditions is replaced by a desperate restlessness born of fear that recalls the excitement and incessant movements of mania.

in brain disease upon which an exact classification of insanity according to cause could be formulated. Kraepelin's arrangement is to-day probably the most satisfactory, being based *upon causes so far as known, upon symptom-groups,* and *upon similarity of course and termination of cases.* It is the intention to consider at this time impulsive and moral insanity only; but so much as has been said concerning general classification had as its object (1) to recall that until the early part of the nineteenth century recognized insane conditions comprehended in all a few pregnant types which, in cases not utterly frenzied or incoherent, would exhibit with great constancy some forms of delusion, viz., maniacal and melancholic conditions and that of so-called monomania;[1] and (2) to point out that since that time complexity of insanity classification has been due on the one hand to ignorance of cause, in respect to which some progress has now been made (*i. e.*, recognition of causal toxins), and on the other to the tardy acknowledgment of instinctive insanities unassociated with delusions. Such false beliefs having from time immemorial been looked upon as evidence of insanity, the acceptance of any form of mental alienation without delusion, aside from the congenital defect of idiocy, became difficult. Witness in this respect Casper's definition, so late as 1857, as it appears in his *Handbook of Forensic Medicine,* translated from the German for the London New Syndenham Society: "Insanity is a disturbance of self-consciousness based upon delusions." According to this, insanity without delusions does not exist.

French alienists, beginning with Pinel (1745–1826), under the title *manie sine delire,* gave publicity to cases of mania in which it was stated no delusions were exhibited. Approximate observations had at an earlier date been made by Ettmuller under the name *melancholie sine delire.* We have already gained some insight as to how cases of the same class could receive such seemingly opposed designations (see note, p. 1058); also, since all recognized forms of insanity which were compatible with a somewhat collected demeanor—*i. e.*, partial insanity, monomania—betrayed themselves by delusions, many or few, mania or melancholia without delusions became equivalent to mania or melancholia without insanity. Not only Casper, but Griessinger, Henke Moreau, Baillarger, and in America Gray and Winslow, wrote against the unreason which assumed the possession of an intellect normal in all respects other than that which related to the commission of a crime and at all times but at the moment of its commitment. Owing, however, to Pinel's reputation and influence, we find to this day lengthy

[1] It may be here stated that although courts sometimes still use the terms monomania and partial insanity in the discussion of insane states, most alienists do not, because it is recognized that a delusion in reference to a few lines of thought or even to one, must affect judgment, a collective attribute of the mind.

arguments to combat this claim where writers discuss irresistible impulse and moral insanity from a legal point of view; but modern psychiatry and the law are as one as regards the repudiation of the doctrine that an isolated insane act may be committed by a person in complete mental health just previous to and immediately subsequent to it. Meantime, the clinical recognition of insane states by Pinel and his school, wherein, without delusion, occur the commission of immoral acts—viz., to kill, to destroy, to wound, to steal, etc.—which are crimes when committed by responsible persons, involved a broader conception of insanity than had existed up to their time.[1]

Pinel's cases of *manie sine delire* and those of his school resolve themselves chiefly into three classes, namely:

1. Certain forms of degenerative insane states (Kraepelin), meaning *impulsive insanity and moral idiocy.* Moral idiocy always, and impulsive insanity usually, is unassociated with false beliefs; but where delusions are experienced it is in the form of hallucinations often occurring at the moment the act is accomplished. Like the aura of epilepsy, the hallucination has no causal relation to the reflex movement. Without doubt, delusions which develop action may be harbored by persons who are subject to an irresistible impulse; but in this case delusional insanity is associated in the same subject with the degeneration type.

[1] However, Casper's viewpoint that insanity is a disturbance of self-consciousness based upon delusions is still the one usually taken by American and English courts. The former have frequently recognized an irresistible impulse as a valid defence, but either this term has been misapprehended in that it has been applied to some act evidencing the usual ill-considered and impulsive action of the insane, often indeed responsive to delusion, or, true uncontrollable impulse being recognized, we may yet find upon exposition that at least phraseological concession has been made to long teaching of the omnipresent delusion as cause of violence, as witness the charge of Chief Justice Shaw, of Mass. (Wharton, Mental Unsoundness and Psychological Law, § 156), who, in reference to monomania stated: "1. Either the delusion is such that a person under its influence has a real or firm belief of some fact not true in itself but which if it were true would excuse his act, etc. 2. Or this *state of delusion* (italics mine) indicates to an experienced person that the mind is in a diseased state, that the known tendency of that diseased state of mind is to break out into sudden paroxysms of violence, venting itself in homicide or other violent acts toward friend or foe indiscriminately; so that although there are no previous indications of violence, yet the subsequent act connecting itself with the previous symptoms and indications, will enable an experienced person to say that the outbreak was of such a character, and for the time being, it must have overborne memory and reason, that the act was the result of the disease and not of a mind capable of choosing; in short, that it was the result of uncontrollable impulse and not of a person acted on by will." If in this instance *delusion* was used in the broad sense of *error* and "state of delusion" is equivalent to mental alienation, then the phrase becomes misleading where used in connection with impulsive insanity. Certain it is, that in forensic discussion of specific cases of insanity the term delusion had best be employed in its more limited medical sense. English courts have usually looked with less favor upon the doctrine of irresistible impulse than those of America. Wharton (§ 152, vol. i.) says in reference to their rejection of this state as a defence for crimes: "No person however insane can by the law as now (1882) expounded by those courts be acquitted of a crime if it appears to the satisfaction of the jury that he knew the nature and quality of the act he was doing or if he did not know it, if he knew the act was wrong." Some English views concerning knowledge of right and wrong in cases of impulsive insanity will be quoted later on.

2. Instances in which the subject is possessed by delusions, but these are exhibited in so slight a degree and are associated with reasoning power so closely approximating that which is normal that they were ignored by earlier clinicians (*folie raissonante, mania mitisima, hypomanie*).

3. Cases of *melancholia activa*, in which the constant dread of something unknown, but fearful, which hangs upon the patient like a pall of doom, is translated into a violent act, in which delusion as an hallucination or in the sense of a deprivation of reason probably does exist, but whose connection with the patient's act could not be or failed to be established.

Casper[1] contended that all of Pinel's cases of *manie sine delire* really belonged to Class 3 of the above. This is not true. Casper's error is best demonstrated by a perusal of his own cases, which he details clinically, and wherein characteristic data of degenerative types are classed with forms of insanity dependent upon delusions. Three brief reports by Pinel on as many cases are reproduced in Casper's *Handbook of Forensic Medicine*, and are substantially as follows:

CASE I.—A man, indulged by his mother in his youth, was perfectly rational when quiet, managed his large property with propriety, fulfilled social duties, and was beneficent; but he was constantly quarrelling, opposition increasing his anger. If a horse, sheep, or dog annoyed him he killed it at once. In society he gave and received blows. Wounds, litigation, and fines had been hitherto the sole result of his quarrelsomeness, but one day he got incensed against a woman who had offended him and threw her in a well. Casper complains "that this account resembles a horrible newspaper anecdote more than a medical observation." We must agree that the story is as unsatisfactory as a clinical history, as it is lacking in data to determine the presence or absence of criminal motive. Casper asks: "What was his conduct during the time just preceding the act? what was it subsequently? what was his relation to the murdered woman, or was he really a man of violent passions who could not, because he would not, command himself? On these and many other points Pinel is silent." And yet we may be sure that some degree of imbecility as typically displayed in certain degenerative states existed in this case. Gauged by the common standard of his society, the exhibition at mature age of a lack of mental equipoise and restraint which so continually resulted in violence, the immediate product of a first emotion, side by side with developed talents in special directions, can be explained in no other way. Such a conclusion, however, is by no means equivalent to the withdrawal of entire responsibility for this person's acts.

[1] It may appear to some that discussion of opinion advanced by some of the older authorities in reference to forms of mental alienation that are now included under the degeneration insanities is reviewed without good reason, because of the better classification and fuller knowledge already acquired by modern psychiatry. While it is true that a physician may view much that is adduced as of mere historic interest, he would find that authorities who discuss moral insanity and irresistible impulse from the legal side still quote the earlier writers of the subject in hand, and base their judgment largely upon their opinions.

CASE II.—A man who periodically experienced a burning sensation in the bowels, intense thirst, obstinate constipation, the face becoming flushed, the temporal arteries pulsating violently, was also seized at these times with an irresistible desire for blood. If cutting implements were at hand he was ready to sacrifice, in a kind of fury, the first person he came across. Even during the attack he was in possession of his reason, answered questions correctly, betrayed no incoherence of ideas; indeed, felt the horror of his situation. At one time he warned his beloved wife to flee in order to avoid a violent deed; at another time, while in the hospital, he stabbed himself in the breast and arm. The paroxysmal desire to commit sanguinary violence, with realization of the evil character of the deed—at least during the time of sufficient consciousness to permit conscience to inspire repulsion—and also the absence of ordinary motive, in that his fury is vented upon the first person at hand, at one time even upon himself, present characteristic marks of true impulsive insanity. Had it been looked for, a sexual element would probably have been found associated with the paroxysm. It is significant that Casper refers the discussion of this case to a chapter on *homicidal monomania*, concerning which he says: "The observation that men occasionally commit murder without any of the usual motives—indeed, under the most remarkable circumstances and apparently on the most sudden impulse, and that, frequently, on persons most dearly beloved by them—is not of recent date," etc.; and this from an authority who even contended against the existence of an irresistible impulse!

CASE III.—A man whom the mob, during the French revolution, freed from Pinel's asylum. This person declared his confinement in fetters with lunatics to be the most horrible injustice. He was set free with shouts of "Vive la Republique!" But the sight of so many armed men, their furious shouts, their countenances flushed with wine, aroused the fury of the lunatic. He forcibly wrested a sabre from one near him, hewed right and left around him, and had to be taken back to the asylum. One agrees with Casper that the selection of this case to demonstrate "mania without delirium" is most unfortunate. The fact that the patient had to be returned to the asylum proves he was not unjustly confined with lunatics. If a paranoiac, a delusion of persecution may have incited him to "hew about" for revenge; but, what is more likely, he probably aped the violent actions of those about him from sheer weakness of intellect, and for this reason also failed to distinguish friend from foe.

And yet Casper, who quoted Pinel to better prove, as he thought, the absurdity of insane irresistible impulse, and who as the much-sought forensic physician was greatly concerned in the embarrassment of the practical administration of justice which recognition of novel forms of insanity entailed, had not failed to observe instances of impulsive insanity, as yet another quotation from his chapter on homicidal mania[1]

[1] Casper urged that homicidal mania be stricken from the classification of insanity. Disregarding errors which arose from failure to recognize insanity unassociated with delusions, modern psychiatry must nevertheless appreciate his efforts to correct the fashion of his day to formulate long lists of insane types often theoretically constructed by metaphysicians, or again, as in the above instance, merely based upon the name of the morbid act.

demonstrates. He says: "There are still other cases whose actual existence I am all the less anxious to deny, as I myself have had occasion to make similar observations. These pure cases—that is, those in which without the individual having labored under any form whatever of insanity, or having been, from any bodily cause, suddenly and transitorily affected by mental disturbance; those cases, therefore, in which there coexisted with otherwise mental integrity an inexplicable able something, an instinctive desire to kill (Esquirol, Mark, Georget, etc.)—are extremely rare, or, rather, there are extremely few cases published, for I am convinced that such pure cases actually occur far more frequently than their literary history would seem to show." We demur from this opinion, as from that of Pinel, that impulsive insanity coexists with mental integrity; and we marvel, in view of the similarity of this statement to that of Pinel's, which follows, that Casper denied the existence of a *manie sine delire*. Pinel had stated "that there are madmen in whom there is no perceptible alteration of the intellectual process, of the perceptions, judging faculty, imagination, or memory, and yet a perversion of the manifestation of the will, in a blind impulse to the commission of violence or even bloodthirsty rage, without any assignable dominant idea, any delusion of the imagination which could cause such propensity."[1] We gather from statements by Maudsley[2] that Esquirol, Pinel's greatest pupil, at first believed, as did Casper, that all of Pinel's cases of *manie sine delire* were really examples of melancholia. This was his opinion at the time he published his article on "Mania" in the *Dictionnaire des Sciences Médicales*, in 1818; but subsequent observation compelled Esquirol to abandon it and to declare that although some insane persons committed homicide in consequence of delusions, hallucinations, or illusions, there were unquestionably others who were driven by an instinctive impulse—a blind, instantaneous impulse, independent of the will—and who acted without passion, without delusion, without motive. To this condition—the *manie sine delire* of Pinel—he gave the name *monomanie instinctive*, distinguishing it, in the first place, from true monomania—*i. e.*, *monomanie intellectuel*—in which there was delusion, and, secondly, from *monomanie affective*, or *moral insanity*. Moreover, Esquirol withdrew from the untenable position of Pinel (one taken later, as we have seen, by Casper as well), and regarded as psychologically impossible an insanity of any kind in which the understanding is not 'more or less affected'"—an opinion which placed this authority in line with the views of modern alienists.

Also, the eminent German alienist Griessinger, as a perusal of his

[1] Wharton, § 541, Mental Unsoundness and Psychological Law.
[2] Responsibility in Mental Disease, p. 153.
[3] Translation by Dr. Chipley. Quoted by Wharton, § 542.

work[1] easily establishes, seems to have occupied the anomalous position of inveighing against and yet recognizing the existence of insane irresistible impulse; but we find upon examination that his objections are aimed against what in reference to that doctrine has not stood the test of time—*i. e.*, errors arising from the blending of true and false characteristics of this form of mental alienation. For instance, the term *monomania*—used after Esquirol by the medical profession for so many years, and to this day by the judiciary—encompassed both delusional insanity following markedly one or two lines of thought and the clinically observed insane uncontrollable impulse; hence, the latter shared in Griessinger's contention that the mind as a whole must be influenced by any cause which evidenced insanity in any one direction. Again, Griessinger, like Casper, objected to the custom, in vogue in his day and our own, of making "the deed itself the distinctive mark of an abnormal mental state (homicidal mania, kleptomania, etc.) as alike dangerous to science and to practice." But this opinion, to which modern psychiatry also subscribes, was with him no more equivalent to non-belief in an irresistible impulse to kill, to destroy, to steal, etc., than is the same opinion of present-day science, for he adds: "But, finally, are there not cases in which in criminal deeds a morbid mental state exists and has influence, and yet presents no external manifestations? I believe it possible. Who would dare to trust himself to separate his mental mechanism as one would lay open the leaves of a book? Who would deny the possibility of an active organic influence of a morbid nature, not exactly noticeable, when disturbed and disordered at the moment of action, turning the scale to crime? In this sense I was compelled to express myself at the bar in the case of a murderer who suffered from well-constituted vertigo epileptica. I was constrained to say that neither before, nor at, nor after the deed did we find certain signs of mental disturbance, yet, notwithstanding, *it was possible that this disease allowed influences to act in the phenomena of volition which obscured reflection and weakened freedom of will, without, however, manifesting themselves by any external symptom*" (italics mine). But, it may be suggested, this is epilepsy. The precipitate convulsive muscular spasm of epilepsy, and the approximately voluntary, although perhaps long and consciously resisted, act of impulsive insanity, appear to be widely diverse morbid phenomena. Not so, however, when, as in the case cited by Griessinger, the *vicarious equivalent* of the spasm is recognized. The unstable neural response to external stimuli in both instances has a common origin.[2] Another time

[1] Mental Pathology and Therapeutics. W. Griessinger, trans., 2d edition.

[2] E. D. Fisher (Medical Jurisprudence, Becker and Witthause, vol. ii. p. 275), quoting Simon, tells of a case of pyromania: "A young quarryman had set fire to thirteen quarries, barns, and buildings. The multiplicity of the crimes, the identity of the circumstances attending the

Griessinger says: "Almost as obscure—*i. e.*, as those fits of spurious violence which arise from melancholic anxiety—in so far as the motives which dictate them are concerned, yet of the greatest importance in a medico-legal point of view, are those cases where individuals, hitherto perfectly sane and in full possession of their intellects, are suddenly and without assignable cause seized with the most anxious and painful emotions and with a homicidal impulse as inexplicable to themselves as to others." Following this are detailed a number of cases of impulsive insanity. Griessinger, like Casper, has been regarded a bulwark among the opponents of the doctrine of irresistible impulse. However, examination of his writings prove that, like all alienists of considerable clinical experience, he had observed cases exemplifying this condition; but he was alive as were the conservative authorities of his time to the danger of a formal recognition of this mental state because of the easy generalization and laxity of application by its earliest advocates. That paragraph in Griessinger's work which is a favorite quotation to prove this author opposed to a belief in uncontrollable impulse is as follows: "Whether and to what extent certain directions of the will and impulses of the insane—particularly such as lead to criminal acts—are irresistible, is a question which can scarcely ever be answered with certainty. Few of the acts of the insane have the character of forced, purely automatic movements. In mania, also, according to the testimony of individuals who have recovered, many of the wild desires could often be restrained. The criminal deeds of the insane are not generally instinctive." Here are general statements, found in the chapter on "Anomalies of the Will," from none of which advocates of insane irresistible impulse will dissent. The sane judges the insane mind and the actions growing out of the latter as best it can. It could never follow all the crochets of abnormal reasoning, even if suppressed causes and motives were known. And, again, who will doubt that, viewed not in relation to acts of degeneration insanity without delusion, but in regard to those of all varieties of lunacy, few insane acts are forced and purely automatic? What Griessinger observed and thought concerning the special cases which

accomplishment, and the doubt of the existence of a motive, led the authorities to ask for an examination of the mental condition of the accused by Tardieu and Lasigue. These declared the accused impulsive and irresponsible, and recommended his commitment to an asylum. An epileptic seizure soon after explained unmistakably the cause and nature of his impulse." Savage says (Epilepsy and Insanity, Dict. Psychological Medicine, p. 453): "There are certain cases of moral insanity (impulsive insanity as employed in this article) in which there are no very clear evidences of convulsive seizures at first, though these may develop later, and with these occur certain impulsive destructive acts which in many particulars resemble in character the purposeless yet energetic muscular acts which form part of an epileptic fit, and in the two classes of cases similar discharges of nerve force along paths of the least resistance take place and may become habitual by recurrence." Clouston (Clinical Lectures on Medical Diseases) makes a class of the epileptoid manifestations of irresistible impulse in his excellent chapter upon the subject.

came under his notice we have seen. And so it will be found that a review of the clinical observance and recognition among alienists of an overmastering and at times pleasurable impulse proves that authorities who opposed moral insanity (including in this term both impulsive insanity and moral idiocy) were really mere protestants against Pinel's and later Prichard's conception of a mental state which coupled reason and unreason—against what Wharton terms "the compartment theory" of moral insanity, which assumes that one may be insane morally and not intellectually. Prichard, the father of the universally adopted term moral insanity, added not a little confusion to medico-legal discussion of our theme, and in this way: Pinel had said—and this quotation is cited by Prichard himself—"We may justly admire the writings of this philosopher (Mr. Locke) without admitting his authority upon subjects not necessarily connected with his inquiries. On resuming at Bicetre my researches into this disorder—*i. e.*, insanity—I thought, with the above author, that it was inseparable from delirium or delusion, and I was not a little surprised to find many maniacs who at no period gave evidence of any lesion of the understanding, but who were under the dominion of instinctive and abstract fury, as if the active faculties alone had sustained injury."[1] Again, the novel insane type wherein insane action was associated apparently with normal understanding, this conclusion being derived from an absence of delusion and retention of considerable power to reason coherently. With the correction advanced by Griessinger and others, who urged the necessity of recognizing the human mind's unity of function, Pinel's conception could at once have been translated to that of the present day concerning impulsive and moral insanity. Unfortunately, however, Prichard extended Pinel's idea so as *to encompass that frequent state of mind in chronic maniacal conditions wherein are associated a degraded ethical standard for conduct and ability to reason plausibly.* This moral insanity, or "morbid perversion of the natural feelings, affections, inclinations, temper, habits, moral disposition, and natural impulses, without any remarkable disorder or defect of the intellect or knowing and reasoning faculties, and *particularly without any insane illusion or hallucination*" (italics mine), Prichard discovered not only in the degeneration states without delusion that we are at present considering, but also in the various maniacal forms of delusional insanity—*i. e.*, the monomanias, or, as expressed in modern nomenclature, in cases of paranoia, circular insanity, senile dementia, etc. It is therefore obvious that Prichard, who defined Pinel's conception accurately, erred in the application of his definition. Thirty years since the alienist Maudsley used the term moral insanity in the modified sense, viz., as an expres-

[1] J. C. Prichard. A Treatise on Insanity.

sion of that general letting down of a moral ethical nature often noticeably coincident to a developing acquired insanity; while within recent years Clouston has found it advantageous to designate this condition as *Prichard's moral insanity.* Medically, then, the term in this sense is obsolete, and its use should be avoided, that it may finally be discarded by legal writers also.

And we may finally ask, in the interest of a more specific nomenclature, that irresistible impulse in the sense of impulsive insanity as distinguished from that of moral insanity (moral idiocy) be no longer used synonomously by medical men and the courts.[1] To-day alienists such as Clouston, Krafft Ebing, and Kraepelin may differ as to the expediency of classification, but each looks upon the mental types which are encompassed by the definitions of impulsive insanity and moral idiocy as degenerative forms of mental alienation. But palpable differences exist in typical cases. The motive of the morbid impulse in the former possesses no moral alignment to those of the subject's acts in general; also, unless mental obscurity and desire have been developed with equal suddenness, the impulse has to a more or less extent been resisted by the subject who has been able to review objectively his intention. Afterward, if the act be accomplished, this person, who can scarcely be said to experience true remorse, may in some cases possess a semblance of this feeling subsequent to the mental ease following immediate completion of desire. Examples most important to forensic practice are impulses to steal, to kill, to commit lustful acts, to set fire to or otherwise destroy property, and to commit suicide.[2] On the other hand, the moral idiot, always completely conscious, continuously or as opportunity offers, likewise administers to his sense-pleasure, but merely in this case obeying the first dictates of self-interest, and, having no thought beyond his wish, acts without the least mental resistance. This insane type is most frequently exemplified by those unnatural children who find delight in torturing animals, maliciously tormenting weaker playmates, persecuting some old or helpless relative—children who will steal, sometimes murder, or plan a considerable destruction of property to satisfy a childish whim or accomplish a childish revenge, and whose

[1] J. Robertson, of Kentucky. Quoted by Wharton, § 175.

[2] Kraepelin classes separately as constraint insanity (Zwangsirresein) those instances of fearsome and unseemly impulse without delusion which we know as *imperative conceptions.* When analyzed we find these impulses to consist of resisted repellant acts: 1, whose remote sexual germ generally passes unrecognized, viz., an idea of this nature, "what if I should plunge a knife in that soft flesh;" or 2, when the thought is fearsome because it has its origin in an effort toward self-preservation. According to their nature one may trace a talismanic idea of protection or one of direct material danger, viz., fear to jump from a high, open space, or to be alone in a dark wide area, fear to refrain from reassuring one's self that a door is locked, that a certain paper is within the sealed envelope, fear to refrain from counting up a certain number, from touching certain objects, etc.

demeanor proves an inability to duly appreciate the character of their acts despite all instruction. Viewed objectively and alone, scarcely a single characteristic has been mentioned but may be duplicated by criminal propensity. Because of this, facts elicted in reference to these insane types are viewed by the public with misgiving, the latter to a great extent believing that the enthusiasm of physicians has resulted in false conclusions which, if accepted, would dissolve society's safeguards against the deeds of the evil-minded. However, upon examination it will be found that the accumulation of clinical evidence in favor of the existence of insane morbid impulse has, willy-nilly, forced itself upon all who have given the matter study, and is a conviction which has by no means been confined to the medical profession. Where physicians have attempted to deny clinical evidence in this matter their own experience, if published, is apt to prove their contention unreasonable. This has already been shown in our review of the conception and development of the irresistible impulse idea as an explanation of unlawful acts; yet as distinctly bearing upon this false position we may yet adduce the following from that fountain-head of forensic knowledge, Casper's *Forensic Medicine*. He who says that "the unscientific and untenable doctrine of morbid impulses and their constraining power in the causation of crime has been sought to be introduced into forensic medicine and practice for the benefit and advantage of frail mortality," nevertheless records in his chapter on homicidal monomania two "pure cases" which he personally observed—one homicidal in character, the other an impulse toward self-mutilation. These morbid impulses were resisted. Not so, however, was that of a subaltern (also a clinical observation from Casper's own practice) who "had from his youthful years labored under the extraordinary 'monomania' that whenever he saw whips hanging out at a belt maker's he was immediately seized with sexual desire which had at once to be gratified." The relation of such imperative desire to possible crime if gratification were difficult is manifest.

This typical example of masochism Casper calls "a fixed idea" having "the actual strength of a true insane delusion—not merely a caprice—and yet the integrity of the mind still continues." We have nothing to do here with the extended interpretation of an insane delusion, but we need take note of that incongruity that admits an impulse morbid to insanity and yet demands complete control of action by the sane part of the same mind—an idea familiar to legal conceptions of partial insanity since Lord Hale's time. But, strangest of all, is Casper's contention against the position of Heinroth and Ideler and in favor of the verity of paroxysmal dipsomania ("periodic intoxication insanity"), which no one to-day would think of differentiating in kind

from other periodic morbid impulses. Two cases personally observed are detailed.

For reasons already given we are not surprised that the legal view of this important question has developed opposition to the theory of an irresistible impulse. So much as is born of a reasonable conservatism in the desire to protect society can only be lauded; but, as we shall see, courts of law, which in general have viewed the theory of an uncontrollable impulse with the greatest disfavor, have at times been compelled to recognize it as a real causal factor of crime. For a better appreciation of this point, recognized amidst great legal conservatism, some landmarks in the history of English law in reference to the criminal responsibility of the lunatic will be first recorded. Lord Hale (1609–1676), who had recognized a complete and a partial insanity (approximating in our time an acute and furious mania or utter incoherence as differentiated from various forms of delusional insanity associated with some power of sequential reasoning) ascribed legal irresponsibility to the former, but entire responsibility to the latter form. Justice Tracy, in 1723, following the same rule, stated that to be exempted from punishment "it must be that a man is totally deprived of his understanding and memory, and doth not know what he is doing, no more than an infant, than a brute, or wild beast; such a one is never the object of punishment." The same rule was advanced by the attorney-general in the prosecution of Hadfield, in the year 1800, for shooting at the King; but was now discredited by the principle advanced by Erskine, for the defense, that "delusions where there is no frenzy or raving madness is the true character of insanity." The effect of the rule laid down by Erskine, whose client was acquitted, was far-reaching; but the principle was not formally sanctioned. In 1812, in the course of a trial for homicide committed by one Perceval under the influence of an insane delusion, the attorney-general prosecuting stated (the presiding judge concurring therein) "that, although a man might be incapable of conducting his own affairs, he may still be answerable for his criminal acts if he possess a mind capable of distinguishing right from wrong." Maudsley[1] calls attention to the fact that it was the power to distinguish right from wrong generally, and not in relation to the particular act in question, which was made the criterion of responsibility in this case, for it was said: "If such a person were capable in other respects of distinguishing right from wrong there was no excuse for any act of atrocity which he might commit under this description of derangement. It must be proved beyond all doubt that at the time he committed the atrocious act he did not consider that murder was a crime against the

[1] Loc. cit., p. 99.

laws of God and nature." The insane Perceval was executed. In 1843 occurred the murder of Drummond by McNaughton, who shot the former under the insane delusion that he was being followed, his character blasted, etc., while at the same time it was shown that the homicide "had transacted business a short time before the deed, and had shown no obvious symptom of insanity in his ordinary discourse and conduct." The defendant was acquitted on the ground of insanity. Maudsley says: "Thereupon the House of Lords, participating in the public alarm and indignation which were occasioned by the acquittal, propounded to the judges certain questions with regard to the law on the subject of insanity when it was alleged as a defence in criminal actions, the object being to obtain from them an authoritative exposition of the law for the future guidance of the courts. The answers of the judges to the questions thus put to them constitute the law of England as it has been applied since to the defence of insanity in criminal trials." In these answers it was stated that "to establish a defence on the ground of insanity it must be clearly proved that at the time of committing the act the party accused was laboring under such a defect of reason from disease of the mind as not to know the nature and quality of the act he was doing, or, if he knew it, that he did not know he was doing wrong." This was a great advance upon the position assumed by the court in the Perceval case, for henceforth criminal responsibility in the alleged insane was to be dependent upon the mental condition at the time of committing a specific act, and not upon a knowledge of right and wrong in reference to various episodes of life-conduct abstractly contemplated; also, the latter rule, by its more comprehensive "defect of reason," with benefit superseded the principle laid down by Erskine, for as well need delusion, in the absence of frenzy, not typify insanity as it is possible that madness exist without false beliefs.

And now as regards some knowledge of right and wrong in the insane. We have seen that in 1812, if possessed by them even as regards matters remote from the offence in question, responsibility was established. The insane often possess such knowledge, although its development is not logical. It is vague, indistinct, even as Lubbock says of the inherited knowledge of children, that they know there is a wrong and a right, and yet they cannot properly categorize occurrences; or ethical perception of the insane may be reasonably clear along one line and absent concerning another. To illustrate this point we may borrow another leaf from the authoritative Casper's vast clinical experience, and incidentally it may be noted how the opponent of impulsive insanity records in Case II. a morbid, pleasurable impulse without delusion.

CASE I.—A deaf-mute twice forced his way into the house of a sexton and demanded the latter's daughter for his pleasure. Being threat-

ened, the mute attacked the girl's father. Upon precognition he smilingly confessed these deeds; also that he might have killed the sexton, and that this would have cost him his head. After long consideration he also remembered the ten commandments. His general demeanor led Casper to pronounce this man irresponsible.[1] Casper also says: "It is well known that lunatics, though they no longer possess actual 'power of discrimination,' yet have a certain instinctive foreboding of what is allowed and what forbidden. From this never distinct knowledge such lunatics are observed to conceal stolen goods, deny the deed, and exculpate themselves until they are palpably convicted."

CASE II.—Herein is recorded of a sensible, educated woman of pure morals that she had gone deranged fifteen years previously, had remained so many years, had been declared judicially "imbecile," but had now regained full and free use of her understanding. "With the greatest composure she communicated to me many particulars in regard to her derangement and its excesses, describing with the utmost distinctness her then powers of ratiocination. For a time she was impelled to break panes of glass with stones; but she knew how improper this was, *therefore she threw the stones carefully, so as not to break the glass, but if this happened, then she rejoiced at it.* . . . I relate this case here, however, because it gives a most instructive peep into the interior of a mind under the trammels of disease; gives from a credible witness a confirmation of a well-known psychological experience, that those mentally diseased may not only have a clear cognizance of the difference between good and evil, but also that even in respect to their obscure consciousness they can command themselves up to a certain point. The discipline of every lunatic asylum is based upon the very proper recognition of this fact."[2]

From all of the foregoing, therefore, we may declare that the position of modern alienists, viewed so frequently with disfavor by the courts, only differs from oft-quoted opponents within their own camp, in that the

[1] Casper. Loc. cit., vol. iv. p. 344.

[2] Casper. Loc. cit., p. 147. Observations by Maudsley (loc. cit., p. 3) very similar to these are brought out in a discussion of a subject closely related to knowledge of right and wrong, viz., the fact that insane persons sometimes act from motives which also actuate the sane. He says: "Were the observer, whether casual or skilled, to reside for some length of time in an asylum, and thus make himself practically acquainted with the ways, thoughts, and feelings of its inmates, he would certainly discover how great a mistake it is to suppose, as is often done, that they are always alienated from themselves and from their kind as not to be influenced by the same motives as sane persons in what they do or forbear to do. When an insane person is on trial for some criminal offence, it is commonly taken for granted by the lawyers that if an ordinary motive for the act, such as anger, revenge, jealousy, or any other passion can be discovered, there is no ground to allege insanity or at any rate no ground to allege exemption from responsibility by reason of insanity. The ideal madman whom the law creates is supposed to act without motives, or such motives as it enters not into the mind of a sane person to conceive, and if some one who is plainly mad to all the world acts from an ordinary motive in the perpetration of an offence, he is presumed to have acted sanely and with full capacity of responsibility. No greater mistake could be made. Much of the success of modern humane treatment of insanity rests upon the recognition of two principles: first, that the insane have like passions with those who are not insane and are restrained from doing wrong and constrained to do right by the same motives which have the same effects in sane persons: that these motives are only effective within limits, and that beyond those limits they become powerless, the hope of reward being of no avail, and the expectation or infliction of punishment actually provoking more unreason and violence."

attempt is now made to classify generically insanity which chiefly involves perception, assimilation, and application of ethical principles.

Not otherwise than the experience of clinicians has also been that of many courts, whose study of criminal action and its motives in the degenerative insane has convinced them of the genuineness of the morbid phenomena presented. In these instances courts which apparently concede to the conditions named the right to plead insanity as a defence have usually framed a charge based upon the English rule as expounded to the Lords, yet referring more directly to existing special conditions. Such a charge by an American court has already been referred to (see note, page 1060). As has already been mentioned, English courts have, as a rule, been more rigid in dealing with alleged irresistible impulse than have those of our country. Nevertheless, British courts, too, have at times expressed the usual dictum concerning responsibility so modified as to permit the jury to decide whether the conditions of irresistible impulse or moral idiocy was established by the evidence, and to state the degree of criminal responsibility possessed by the accused. Thus Ogsten quotes a charge of the Lord Justice Clerk, of Edinburgh, delivered in 1863: "If a man knows what he is doing—that is to say, if he knows the act that he is committing; if he knows also the true nature and quality of the act and apprehends and appreciates its consequences and effects—that man is responsible for what he does. If from the operation of mental disease he does not know what he is doing, or if, although he know what is the act he is performing, *he cannot appreciate it or understand* (italics mine) either its nature or quality, its consequences, or effects, then he is not responsible." In a charge of Lord Deas, at Aberdeen, it was said: "If the jury believed the prisoner, when he committed the act, had sufficient mental capacity to know, and did know, that the act was contrary to the law and punishable by the law, it would be their duty to convict him."[1] Here not alone are all special tests for insanity put aside. With due recognition of the oft-remarked obscure sense of right and wrong in the insane, the charge in both instances makes paramount the question whether the accused had *sufficient knowledge and appreciation* of the quality of the act to make him responsible therefor.

Something, however, must be said in reference to another side. The scope of ethical conceptions necessarily varies among the insane as it does in the mental make-up of various normal persons, and so it happens that in some cases of undoubted mental defect appreciation of wrong-doing sufficiently approximates the normal to recognize in it a diminished responsibility instead of complete absence thereof.

[1] Francis Ogsten. Lectures on Medical Jurisprudence.

Cognizance of this condition, which is more especially noted in persons who are mentally deficient, yet possess no delusions, has long been taken in forensic cases concerning ordinary imbecile offenders. It is an equally important factor, however, in degeneration insanities. From all of which arises the necessity of disassociating insanity and criminal irresponsibility as equivalents. It is, indeed, difficult, to understand how this idea may be entertained by students of psychiatry, and yet so well-known an alienist as McDonald has said not long since: "The plea of insanity as an excuse for crime rests on the supposition or allegation that the accused is the victim of a form of disorder the existence of which, if established, renders him irresponsible for his acts. This being true, we may properly assume that, medically speaking, insanity and irresponsibility are so closely allied that they are essentially convertible terms, and that whenever the existence of insanity is clearly established the question of responsibility is practically determined. Hence this question of responsibility for criminal acts is, strictly speaking, a medical one, and it can be determined—especially in complex and obscure cases—only by those who are practically familiar with the symptoms of mental derangement."[1] Certain it is that the question of criminal responsibility is never a purely medical one any more than it is a legal one at first hand. Through the medium of the law medical evidence contributes its knowledge to elucidate conditions of mental alienation; but both sciences are employed for the one purpose, to better enable the lay jury, as the representative of the accused's fellows, to say whether the offender shall in some way be set apart from other men because unable or unwilling to be guided in conduct by established general rules; and as regards the doctrine which holds insanity and irresponsibility as convertible terms, this might easily have been developed in the course of opposition to unjust legal rulings whose position (1) denied to well-defined insane types the least immunity for illegal acts, as witness Lord Hale's utterance in reference to partial insanity, or (2) where this position refuses to allow as a mitigating circumstance to crime abnormal mental conditions, whether or not these be recognized as evidence of insanity, as Wharton has said is true of English law in regard to insane irresistible impulse. Nevertheless, McDonald's proposition is not only in itself incorrect, but also by asking, in this day, complete criminal immunity for every degree of mental alienation, it really effects the bad result of taking from some cases of insanity the mitigation of responsibility which is their due.

The layman's idea, which discovers in madness and criminal irresponsibility invariable equivalents, is more easily understood. To him

[1] Carlos McDonald, M.D. The Legal *versus* Scientific Test of Insanity in Criminal Cases. Medical Record, September 23, 1899.

the term insanity brings the picture of very patent manifestations of a diseased mind, viz., violent mania, unmistakable delusions, pronounced dementia, etc.—all conditions wherein only exceedingly inadequate notions of crime could be entertained. And here the importance of the medical expert's testimony and the need that he be properly supported by the court becomes apparent. Very frequently, indeed, the testifying physician is sometimes misapprehended when, in answer to questions of counsel, he pronounces insane this or that condition. The term alike describes a slight deviation from a normal condition of mind and the mental manifestation of grossest mental disease, while it is obvious enough that the same degree of responsibility for conduct does not exist for these extremes of mental capacity. Just in these types of mental aberration which are unassociated with delusion, incoherence, or frenzy at any time (or, perhaps, the last solely at the moment marking the acme of a paroxysmal seizure) is it sometimes necessary to convey to the minds of the jury a conception of insanity which the latter will feel they may not entirely absolve from criminal capacity. We may remember, as somewhat analogous, that the law recognizes in reference to the effect of alcoholic intoxication several conditions which modify responsibility for crime. The immediate cause of the abnormal passions and impulses of alcoholic drunkenness is comprehended and its effects recognized as evanescent. In impulsive insanity and moral idiocy the intoxicating cause, being developed within the organism, is less apparent, but its effect in ebb and flow is more lasting. Altogether, however, from what has been said, develops *the apparent need for sufficient exposition on the part of the medical witness to aquaint the jury with special conditions which apply in these and other forms of degenerate alienation, and as distinctly to be avoided, in the present knowledge of the public concerning these cases, the mere pronouncement of the mental state of the accused as one of insanity.* We find another reason for properly conserved freedom of speech on the part of the testifying physician in the character of his testimony. His opinion is asked in the light of his entire experience, and not only in reference to the facts elicited concerning the case in hand. But even where the question in actual dispute is solely considered, the doctor's diagnosis often rests, perforce, upon other conditions than those perceived in the course of his own examination of the patient, viz., upon the clinical history previous to a certain attack or symptoms noted between the times of the doctor's visits. These are often of material importance, and from them diagnosis, prognosis, and treatment each takes its cue. By experience the practitioner utilizes what is relevant in the testimony of these facts, because such are daily elicited at second hand in the course of his work. Nevertheless, evidence concerning a diagnosis

based upon this hearsay evidence, even when weighed in the balance of professional judgment, must of necessity be of a different nature than the testimony given by an ordinary witness, which must always be personally perceived of sense to be relevant. It is easy to see why a direct affirmation or negative answer may be properly demanded in the latter case, but it is no less plain that a demand of simply a "no" or "yes" from the medical witness, without modification or explanation, by its misleading directness may easily produce a subversion of the truth. One would, therefore, deduct also from this circumstance that a better understanding between the jury and the physician testifying before them would be established *if the court would hold the medical witness under special protection, permitting him to frame all his replies to questions of counsel as he thinks best, provided his testimony is relevant, tends to elucidate the points at issue, and is not extended at too great length.*

Herewith this paper is brought to a close. The writer trusts that to its object, previously set forth, some material facts have been brought to bear, and of these he would regard as of particular importance such as have added testimony concerning the absolute reality of insane irresistible impulse through the pens of medical authority so frequently quoted in opposition to this morbid phenomenon.

REVIEWS.

UND DER NERVENZELLE UND DER ZELLE IM ALLGEMEINEN. By PAUL KRONTHAL. Jena: Gustav Fischer, Verlagsbuchandlung.

THIS volume departs considerably from the usual road followed by writers upon the histology of the nerve cells. The author has selected a topic with which he is not only familiar, but which affords a rich opportunity to his genius to ramble among the devious and highly speculative paths of general cytology. The nerve cell, indeed, has scarcely afforded more than a text from which at the first chance the author has proceeded to diverge. The work is not the less interesting because of that feature; rather it gains in interest because of the perspective which a wide and critical excursion yields.

The author loses no time in stating the method of work, which is to treat parts of the central nervous system with hardening agents in such manner as to preserve relations of cells and intercellular substances. At once, after describing the relatively simple procedures employed to accomplish this end, he dips into a consideration of the theory of the fixation of tissues in which the newer conceptions of physics and chemistry play an important part. This section of the work is, however, no more interestingly dealt with than the next, in which the theory of staining is discussed; and in both sections you are led to feel that the author possesses a keen appreciation of the bearing of modern physico-chemical studies upon histology and physiology.

The descriptions of the figures, which form the strictly original portions of the contents, are given immediately after the methods of study have been discussed, and they furnish the backbone of the work in that the author's original conception of the origin of the nerve cells follows upon their interpretation. This conception appears the stranger since all advances in our knowledge have tended more and more to emphasize the specificity of cells, a specificity, moreover, that applies not only to general morphology, but intimate inner constitution, with which, indeed, function must be closely linked.

In view of these facts and the data which the finer anatomy has given us in such abundance in the past decade, it is somewhat startling to be told that the nerve cells arise through fusion of leucocytes. The absence of mitotic figures and other evidences of regeneration in nerve cells afford, therefore, no obstacle to a belief in their post-embryonic generation, the denial of which the author finds it impossible to accept. He says: "If the conclusion—drawn upon the basis of the histological picture—that the nerve cells rise through fusion of leucocytes is correct, there will be found during the period of growth of the individual many more leucocytes in the central nervous system than in later periods. In that the central nervous system grows rapidly at first, and then progressively slower, so must we find the greatest number of migrating cells

in it soon after birth. From the examination of histological preparations it should, therefore, be possible to state if the tissue were obtained from a young, growing, or fully grown individual. The studies upon rabbits confirms this expectation to the extent of finding the spinal cord of the embryo crowded with cells, while in the adult they are much fewer. The nerve cells are constantly being consumed and as constantly restored through the fusion of leucocytes. Since the appearance of Apáthy and Bethe's publications there is no longer any doubt that the nerve cells are traversed by fibres which come from and hasten to the periphery."

This conception of the origin of the nerve cells will not have many supporters among histologists; but notwithstanding this fact the results of the author's work need not be lost. The methods employed may have advantages, and if the illustrations, which are excellent, can be taken as sufficient guides, they are to be recommended for preserving unimpaired the structure of protoplasm and nuclei and the relation between cells and intercellular substance. Moreover, the second part of the volume, which deals with the general as well as the special histology of cells, will be found highly interesting as well as critically presented. S. F.

SAUNDERS' HAND ATLAS SERIES. ATLAS AND EPITOME OF ABDOMINAL HERNIA. By Privatdocent Dr. GEORGE SULTAN, of Göttingen. Edited, with additions, by WILLIAM B. COLEY, M.D., Clinical Lecturer on Surgery, Columbia University (College of Physicians and Surgeons). With 119 illustrations, 36 of them in colors, and 277 pages of text. Philadelphia and London: W. B. Saunders & Co., 1902.

THIS volume is a useful addition to Saunders' *Hand Atlases*, fulfilling in the most satisfactory manner the purpose of its author, that of supplying the general practitioner and the occasional operator with a reliable and concise book of reference. The publishers have been fortunate in the choice of their American editor, whose views when differing from the author's are definitely stated, thus giving to the book a distinct additional value. The translation is particularly readable and comprehensive.

The first portion of the book deals with hernia in general, including its definition, diagnosis, accidents, and treatment. The second portion has to do with special herniæ, and here are found excellent illustrations serving as reliable guides to the most approved operations of the day.

The editor has anticipated the reviewer in criticising the statement that 70 per cent. of alcohol, when properly employed as an injection for the cure of inguinal hernia in the young, is free from danger. Experience has demonstrated to many operators that although this method may, when properly used, be free from immediate danger, yet the tissues thus treated lend themselves badly to a later operation for radical cure, which in all likelihood will be found necessary. In justice, however, it should be said that the method is not recommended. The author's demonstration of strangulated hernia, and the illustrations of this condition are very comprehensive. He who undertakes to treat a strangulated hernia will do well to read closely what is said regarding taxis. If Sul-

tan's advice upon this subject were generally followed there would be fewer cases of bowel resection, of perforation, and of reduction of gangrenous bowel. J. H. G.

ECZEMA AND ITS CONGENERS: Their Pathology and Bacteriology, with Some Improvements in Their Treatment. By EDWARD BLAKE, M.D., Member of the Royal College of Surgeons, etc. London: Henry J. Glaisher, 1902. Philadelphia: P. Blakiston's Son & Co.

THE title of this little book would naturally lead one to expect a treatise upon eczema and kindred affections, but an examination of its contents shows it to be made up of rather disjointed remarks upon a great variety of subjects not always very nearly related. Eczema, urticaria, herpes, gout, chorea, the teeth, and worms are some of the subjects discussed. Some of the author's statements would be very interesting if true; as, for example, it is stated in the preface that dental bacteria are among the commonest causes of eczema.

Buckley's investigations concerning the urine in eczema are referred to as supporting the view that this malady is a constitutional one. As we interpret this investigator's results, they prove, if they prove anything, that there is absolutely no constant relation between the composition of the renal excretion and this disease.

Minute doses of croton oil or dulcamara are said to be very valuable in the treatment of impetigo contagiosa. Even if these remedies were as useful as claimed, which we doubt very much, it seems a rather roundabout way to treat a strictly local affection which is usually curable in a few days by local treatment.

The author introduces a new remedy for the treatment of eczema, viz.: formalin, which he has used with benefit in one case—a rather limited experience.

The book is not a very illuminating contribution to our knowledge of eczema; it is difficult to consider it as a serious attempt to discuss an important subject. M. B. H.

THERAPEUTICS, PREVENTIVE MEDICINE, CLIMATOLOGY, AND FORENSIC MEDICINE. By GEORGE F. BUTLER, M.D., HENRY B. FAVILL, M.D., NORMAN BRIDGE, M.D., and HAROLD N. MOYER, M.D. Practical Medicine Series of the Year Book. Vol. VII. Edited by GUSTAVUS P. HEAD, M.D. Chicago: The Year Book Publishers.

WE cannot recommend too highly this collection of short abstracts from the most recent literature upon the above-named subjects. The section devoted to Materia Medica and Therapeutics, occupying more than half of the total number of pages comprising the volume, is most interesting and instructive. In this collection the investigator may find an abundance of suggestions for further original work, and the busy practitioner valuable hints as to treatment. The chapter upon Climatology we would consider of great general value, giving, as it does, the temperature range, general climate, altitude, etc., of the regions most often

resorted to by those suffering from tuberculosis. It contains just the information with which every physician should familiarize himself before advising an invalid to attempt a journey for the benefit of his health. The other subjects, though necessarily occupying less space, are also well handled. T. A. C.

THE STUDENTS' MEDICAL DICTIONARY. Including all the Words and Phrases Generally Used in Medicine, with Their Proper Pronunciations and Definitions. Based on Recent Medical Literature. By GEORGE M. GOULD, A.M., M.D. Eleventh edition, enlarged, with many illustrations. Philadelphia: P. Blakiston's Son & Co.

THE fact that his book is now in its eleventh edition is sufficient proof of its worth. It is necessary to add, however, that in this enlargement of over a hundred pages it has not reached the size which renders it too large for ready reference. There has been no change in the general style of spelling and pronunciation which has always characterized the book. It is probably the most satisfactory of all small medical dictionaries.

The paper, type, and binding are to be commended for their durability, which in a book of its nature is very essential. J. H. G.

DISEASES OF THE NOSE, PHARYNX, AND EAR. By HENRY GRADLE, M.D., Professor of Ophthalmology and Otology, Northwestern University Medical School, Chicago. Handsome octavo of 547 pages, profusely illustrated, including 2 full-page plates in colors. Philadelphia and London: W. B. Saunders & Co., 1902.

DR. GRADLE, in his preface, states that in matters of treatment he "details only the procedures which have stood the test of critical experience, and omits those that have failed under this test, even though sanctioned by the tradition of text-books." At first appearance this seems to be rational and wise; but when we come to look through this volume, and find page after page devoted to etiology, symptomatology, and diagnosis, and the treatment often dismissed with a scant paragraph, this method seems open to question at the least. The majority of physicians who will read and study a work of this size and character will be those interested more or less in general work rather than specialists, and for this class of readers the treatment of the various conditions of ear, nose, and throat disease is of at least equal importance, in most cases, to the diagnosis. One cannot help feeling, after the perusal of this work, that after throwing out all the so-called unsatisfactory methods very few are left that the author considers efficient, and that he therefore considers most diseases of the upper respiratory tract and allied regions in a not too hopeful manner.

A fair amount of the work is taken up with anatomy and pathology. Unlike many text-books on this subject, this is not all massed at the beginning of the volume to which the student must turn back for refer-

ence, but is placed in small articles at the head of each chapter or section, treating of a different locality, and in such a manner as to be of distinct advantage.

The book is well and clearly written, and Professor Gradle, in repeating the dictum that "a specialist can never afford to lose his interest in general pathology," emphasizes a fact too often overlooked. At the end of various sections are paragraphs devoted to the history and literature of the subject under discussion, which will be of great interest and usefulness. The illustrations are fairly numerous and well drawn, though there is nothing strikingly new or original in most of them. There are far too few in the latter part of the book, in which otology is taken up.

G. M. C.

A Manual of Bacteriology, Clinical and Applied, with an Appendix on Bacterial Remedies, etc. By Richard T. Hewlett, M.D., M.R.C.P., D.P.H. (Lond.). Second edition. Philadelphia: P. Blakiston's Son & Co.

Since, at the present day, a practical working knowledge of bacteriology is almost indispensable in routine clinical examinations, a textbook dealing with bacteriology, especially in regard to its clinical adaptation, is really of great value. The present book is written to cover exactly this ground. The book is not only confined to a consideration of bacteria and bacterial processes, but likewise includes a chapter on Blastomycetes, a most useful article considering the present importance attached to the pathogenic members of this group; a chapter on hyphomycetes, and a short description of the protozoa, with special reference to malaria. Some space is also devoted to the practical examination of water and milk, and to disinfectants and antiseptics.

The first few chapters deal with the ordinary methods of bacteriological investigation, the technique of stains, and the fixing and staining of tissues. A good, concise account is given of the fundamental principles concerned in the subject of immunity and the protective substances of the body fluids, together with a short discussion of hæmolysis, cytotoxins, agglutinins, precipitins, and the anti-bodies.

Practically all the bacteria pathogenic to man are described, but the descriptions of a few of the less important organisms are entirely too short. The classification of some of the bacteria is useful perhaps from a practical standpoint, but certainly not scientific. Again, although the latest work on the etiology of dysentery is quoted, this affection is classed, for some unaccountable reason, among the diseases of uncertain origin. Such errors are all the more astonishing since the book, on the whole, is thoroughly modern.

The descriptions of the saprophytic bacteria most commonly found in the body excretions are most fortunate. But perhaps the best feature of the book is the page or two of notes placed after the description of each group of organisms, which treats of the special methods of examination for that particular group of bacteria, and appends a list of the lesions where they are most apt to occur. It is this guide for the practical application of bacteriology which gives the book its principal value.

The photomicrographs are excellent, but some of the wood-cuts, especially those in the chapter on malaria, are decidedly poor. The manual contains 520 pages, and is well printed on good paper.

W. T. L.

A MANUAL OF MINOR SURGERY AND BANDAGING. By HENRY R. WHARTON, M.D., Professor of Clinical Surgery in the Woman's Medical College, Surgeon to the Presbyterian Hospital, Philadelphia, etc. New (5th) edition, thoroughly revised. In one 12mo. volume of 612 pages, with 509 illustrations, many of which are photographic. Philadelphia and New York: Lea Brothers & Co.

THAT there should be a call for the fifth edition of Dr. Wharton's book is evidence of the high esteem in which it is held and a gracious tribute to its usefulness. Surgery has made rapid advances during late years, and a text-book on the subject very soon becomes antiquated if not kept constantly revised. This the author has been enabled to do by the successive exhaustion of previous editions, so that student and practitioner alike will find a mine of information there that cannot very often be obtained from larger works, and which represents the latest advances made, not only in minor surgery, but in the technique of major operations as well. For in addition to complete and lucid descriptions of all so-called minor surgical procedures, the volume has sections on all the major operations, and, although not very extensively, explains them in the concise way that impresses the mind of a student. Wharton's *Minor Surgery* is the standard work of its kind, and justly so. The text is accompanied by numerous illustrations, many of them being photographic, and arranged in an admirable manner. Particularly is this so in the section on bandaging, where almost every known variety of bandage or dressing is explained in detail, and with such clearness that a novice could scarcely fail in the application of one. It is praise enough to say that the volume is fully up to the high standard of previous editions, and abreast of the times.

G. M. C.

THE ETIOLOGY OF ACUTE ARTICULAR RHEUMATISM, WITH CRITICAL OBSERVATIONS UPON ITS THERAPY. By A. MENZER, Staff Physician and Assistant of the Illinois Medical University; Clinic of the Royal Charité. With a preface by Professor SENATOR. Gen. Med. Rath.; 5 plates Berlin: August Hirschwald, 1902.

THIS book is practically a monograph upon the etiology of acute articular rheumatism, in which the author thoroughly reviews the recent work upon the subject, and adds, besides, many original observations. The greater portion of the work is, of necessity, allotted to a discussion of the various bacteriological findings in acute rheumatism and their relative importance as the causative factor of this affection; the results obtained from cultures of the joint exudation, the blood, the heart valves, vegetations, etc., are all considered under separate headings. In

the critical review of the subject the work of certain investigators is, perhaps, given undue prominence, while a few more important observations are not sufficiently emphasized. Much stress is laid upon the results of animal experiments, and many interesting and new observations are recorded in which animals have been inoculated with streptococci obtained from sources other than the lesions of rheumatism. The relationship between rheumatic fever and acute tonsillitis is dwelt on, and the recent bacteriological work upon this side of the subject is thoroughly reviewed. Here, again, personal observations are added, and some new experiments described. The chapter upon the treatment of the disease offers nothing especially new, but there are some suggestions as to the future rational treatment based upon the author's conclusions as to the mode of infection and the part played by tonsillitis in the origin of the joint involvement. W. T. L.

INTERNATIONAL CLINICS. Edited by HENRY W. CATTELL, A.M., M.D., of Philadelphia. Vol. II. Twelfth series, 1902. Pp. viii., 292. Philadelphia: J. B. Lippincott Co., 1902.

THIS volume opens with an excellent paper by Lépine on the treatment of diabetes mellitus; but the opinions therein contained should be compared with those of Douglas, who has recorded his investigations on the presence and significance of beta-oxybutyric acid in the urine of diabetics, and its relation to the coma (p. 128). Romme takes up the now thoroughly-known subject of Gersung's method, and commends it. Leguere records two instances of immediate death caused by spinal injection of cocaine, and emphasizes the warnings which have been expressed in other places in this series. Robino covers rather exhaustively, even if somewhat academic, the treatment of simple ulcer of the stomach—not so simple in his treatment as other than the French school may suggest. Eight pages of selected prescriptions are of value therapeutically, but not thorough as to nomenclature. Hepatic cirrhosis is presented by Edwards, although we prefer the term sclerosis used by Benedict in his excellent paper which follows. Then comes a carefully observed and concisely reported instance of pseudoleukæmia, with chronic relapsing fever, by Vickery. May he continue his important contribution! Hemmeter has a further word on gastro-intestinal auto-intoxication, and Patton contributes to the always interesting and somewhat ill-defined subject of bradycardia. Surgery, obstetrics, and gynecology are well represented by Tonnesco, who presents some rather astonishing statements about resection of the cervical sympathetic, by Coley, Gibbs, Senn, and Kelly on various topics. Walker traverses well filled territory in the treatment of acute appendicitis, and takes cognizance of the fulminating forms so often the cause of unpleasant surprises. We are inclined, even from the medical viewpoint, to agree with him, suggesting, however, that if not so frequent as he implies, these cases are of immediate urgency. Of the special articles but one—that of Borissof—on the functions of the digestive glands, based upon the researches of Pavlof and his pupils, rather appeals as of especial importance. This is really to be studied by all advanced thinkers on digestive physiology and pathology. But one "eminent

living physician" is honored with a portrait and sketch in this volume. There is much which is satisfactory in this volume, and while the editorial blue pencil has been spared there is little that should be relegated to the limbo of the hopelessly bad. R. W. W.

A TEXT-BOOK OF PRACTICAL THERAPEUTICS: WITH ESPECIAL REFERENCE TO THE APPLICATION OF REMEDIAL MEASURES TO DISEASE, AND THEIR EMPLOYMENT UPON A RATIONAL BASIS. By HOBART AMORY HARE, M.D., Professor of Therapeutics and Materia Medica in the Jefferson Medical College of Philadelphia. With special chapters by Drs. G. E. DE SCHWEINITZ, EDWARD MARTIN, and BARTON C. HIRST. New (9th) edition. Pp. xv., 857. Philadelphia and New York: Lea Brothers & Co., 1902.

FOR this edition the author states that he has carefully revised the text, included new and useful measures, added nearly one hundred illustrations, and claims it is almost a new work on the subject. We can vouch for the correctness of these statements. The matters which in former editions called for our disapproval, and which are found in the present, are the alphabetical arrangements and the failure to adhere strictly to pharmacopœial nomenclature. The objection to the alphabetical arrangement is somewhat diminished by the classification which is found on pages 43 to 47, inclusive. As for pharmacopœial terminology, each succeeding edition shows a change for the better. No doubt the author will in the future closely follow the nomenclature of the next revision of the Pharmacopœia, in whose production he is taking an active part. Much as we have in other places commended the material found in Part. II., devoted to Drugs, we believe that the most potent reason for the long-continued and deserved popularity of the book is to be found in Part. III., Remedial Measures Other than Drugs, Foods for the Sick, and in Part IV., Diseases. It is in these two parts that the author gives especial proof of the usefulness of the work and the reason for the addition of the qualifying adjective "practical" to the title "therapeutics." Here the student and the practitioner find their interest acute, and here one recognizes the steady progression of the author's opportunity for observation, the faithful use which he had made of it, and the forcible presentation of his conclusions for the use of his fellow man. This edition shows great advance over its predecessors, not only in text but in illustrations. Of methods and medicines but little *ex parte* argument obscures the clean-cut decisions reached after philosophical reasoning and aggregation of collected experiences. This book will not place in abeyance the divorce between laboratory and bedside, because of the simple fact that the author has studied both phases of drug action, and speaks *ex cathedra*, but because the clinician, from his laboratory experience, can reach more accurate conclusions based on a broader foundation than one who has not enjoyed similar advantages. And, further, the practical physician thus trained can translate in the language of practical therapeutics the findings of the

laboratory as no mere laboratory worker can do. We congratulate both author and reader on the improvements which we have noted, and rejoice in the unmistakable evidences of appreciated exertions.

R. W. W.

THE PRACTICAL MEDICINE SERIES OF YEAR BOOKS. Under the general editorial charge of GUSTAVUS P. HEAD, M.D., Professor of Laryngology and Rhinology, Chicago Post-Graduate Medical School. Vol. VIII., PEDIATRICS AND ORTHOPEDIC SURGERY. Edited by W. S. CHRISTOPHER, M.D., JOHN RIDLON, A.M., M.D., and SAMUEL J. WALKER, A.B., M.D. Chicago: The Year Book Publishers, July, 1902.

THE present volume of this series is fully up to the standard of those which have preceded it. The editors have ably selected abstracts from the best literature which has appeared on the subject of pediatrics and orthopedic surgery. The small size of the book makes it convenient for reference, and the very cheap price at which the entire series is sold places these valuable epitomes of literature at the disposal of every physician. The arrangement of the volumes is commendable, the amount of space devoted to each subject being fully equal to its importance or to the value of the literature which has appeared upon it in recent times.

The typography of the present volume shows an improvement over that of past numbers.

J. H. G.

ESSENTIALS OF HISTOLOGY. By E. A. SCHÄFER, LL.D., F.R.S. Sixth edition, revised and enlarged. 8vo., 416 pages, with 463 illustrations. Philadelphia: Lea Brothers & Co.

THE title of this admirable text-book of histology should not mislead one to regard it in the nature of a "Quiz Compend." On the contrary, it is a most complete and painstaking guide for the beginner, as well as a not unworthy book of reference for the more advanced. The work in its previous editions is so well and favorably known in this country that a brief consideration of its revised scope is all that need be made. The volume is arranged as a series of lessons considering in turn the structure of animal cells in general and particular, and followed by studies of the tissues and organs of the animal body. Each lesson is preceded by directions for study which deal with the selection and preparation of material to illustrate the subject at hand. The work is profusely illustrated, not only with the more customary cuts from recognized sources of authority, but also by numerous new drawings by Muir made for this edition. Although many of the illustrations are extremely diagrammatic, the teaching purpose is perhaps better served by them than by the more indefinite lines of the real picture. The more familiar organs are treated adequately and with due regard to later researches on these lines. In addition, it is pleasing to note with what fulness the blood, the nerve cell, and the central nervous system are described.

The organs of the special senses have been considered in detail sufficient for a general treatise. An appendix descriptive of a few of the simpler technical methods of preservation, fixation, and staining of tissues ends the book. The paper, type, and binding are fully worthy of the most excellent text. F. P. G.

A TREATISE ON CELLULAR TOXINS, OR THE CHEMICAL FACTORS IN THE CAUSATION OF DISEASE. By VICTOR C. VAUGHAN and FREDERICK G. NOVY. New (4th) edition, revised and enlarged. 8vo., 480 pages, with 6 illustrations. Philadelphia: Lea Brothers & Co.

No one who has an interest, practical or experimental, in the problems of scientific medicine can afford to pass by this most recent and comprehensive treatise. The field which the authors have chosen is a large one, covering, as it does, all the known toxic products produced by bacterial and animal cells, whether in a state of activity or after death.

The work is of chief value as presenting full, well grouped, and impartial summaries of the original investigations on each subject treated. The importance of a work such as this, which brings into so admirable an order researches undoubtedly interrelated, but confused to all but those especially conversant with the subject, can scarcely be overestimated.

That the conclusions drawn from the original sources are in many places incomplete is due to the unsettled nature of the problems.

The work may be divided conveniently into four different parts, which considered in turn are: first, toxins formed by bacteria; second, toxins (specific substances) present normally in the blood or found in the process of immunization; third, toxins from food substances formed before or after entrance into the animal body by the action of bacteria; and, fourth, methods of detecting ptomaines and leucomaines in foods. Bacteria produce toxins of two sorts—directly, they produce intracellular or extracellular toxins, and indirectly by their action on nitrogenous substances they produce ptomaines. In this connection have been considered the bacterial poisons of certain infectious diseases. On some of them, such as diphtheria, tetanus, and anthrax, we may consider ourselves relatively well informed. On others, such as tuberculosis and pneumonia, nothing very definite has been revealed to us. A consideration of the properties of the blood serum follows. The germicidal properties of the blood, precipitins, agglutinins, and lysins are taken up in turn, and in conclusion the theories of the immunity of Metschnikoff, Bordet Emmerich, and particularly of Ehrlich, are quoted and discussed.

Food-poisoning comprising poisoning by mussels, fish, meat, cheese, milk, and grain is considered in respect to epidemics and to general endemic diseases supposed to be dependent on the use of such improper food. An exhaustive chemical consideration of such bases as have been isolated from these ptomaines, and also of the leucomaine bases—that is, preformed bases of the proteids irrespective of the action of bacteria—follows. F. P. G.

ESSENTIALS OF THE DISEASES OF THE EAR. Saunders' Question Compends, No. 24. Arranged in the form of Questions and Answers. Prepared especially for Students of Medicine and Post-Graduate Students. By E. B. GLEASON, S.B., M.D. Third edition, thoroughly revised. Philadelphia and London: W. B. Saunders & Co., 1902.

THE third edition of this little book is thoroughly up-to-date with the recent progress made in the subject of otology. Although the arrangement in the form of the questions and answers may savor too much of didactic teaching, it is to be remembered that the books in this series are intended to teach the rudiments of the subjects with which they deal, and that their authors are men qualified by their standing in the profession to speak with positiveness upon what they teach.

For the purpose of the student, under-graduate or post-graduate, this book may be recommended as a very reliable guide to the subject. Within its limits Dr. Gleason has succeeded in comprising the essential points which must be learned by those who would seek a knowledge of aural surgery. The illustrations are excellent, and the book amply fulfils the purposes for which it is written. F. R. P.

MEDICAL LECTURES AND APHORISMS. By SAMUEL GEE, M.D. London: Smith, Elder & Co.

THIS admirable little book consists of 13 lectures upon medical subjects and 271 clinical aphorisms. A number of the lectures are illustrated by histories of cases which serve to make them more interesting. Among the more valuable may be mentioned that upon Tubercular Peritonitis in Children and that upon the Signs of Acute Peritoneal Disease. The clinical aphorisms from Dr. Gee's wards, collected by Dr. Thomas J. Horder, contain a fund of useful information concisely and conveniently arranged, adding greatly to the value of the publication. In fact, there is not a page of Dr. Gee's book which is not pregnant with useful and interesting matter gleaned from his vast experience. T. A. C.

PRACTICAL MEDICINE SERIES OF YEAR BOOKS. GENERAL MEDICINE. By FRANK BILLINGS, M.S., M.D. Chicago: The Year Book Publishers.

THE sixth volume of this series, which is under the general editorial charge of Gustavus P. Head, M.D., fully comes up to the standard of excellence established by the previous issues. It is, of course, impossible in a volume of its size to quote from every article upon the numerous subjects treated, but, on the whole, the selections have been good, and the ground of recent medical advances well covered. The chapters upon Typhoid Fever, Malaria, and Yellow Fever are especially full.

T. A. C.

PROGRESS

OF

MEDICAL SCIENCE.

MEDICINE.

UNDER THE CHARGE OF

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AND

W. S. THAYER, M.D.,

ASSOCIATE PROFESSOR OF MEDICINE IN THE JOHNS HOPKINS UNIVERSITY, BALTIMORE, MARYLAND.

On the Pathogenesis of Typhoid Fever.—SCHOTTMÜLLER (*Muenchener med. Wochenschr.*, 1902, xlix. 1561) in the clinic of Lehnhartz, in Hamburg, has, as is well known, made during the last three years a number of valuable observations concerning the culture of typhoid bacilli in the circulating blood during the course of the disease. His observations during the last year have wholly confirmed his earlier results in that out of 101 patients the bacilli have been cultivated 84 times. Positive results were obtained in a large proportion—39 out of 50—of cases on the day of their entry into the hospital. From a very large number of individual culture experiments the author reaches the conclusion that the number of bacilli in the blood bears a more or less direct relation to the clinical symptoms. They were, for instance, appreciably more numerous during the fastigium than in the earlier stages or during the periods of more intermittent temperature. Where the bacteria had already disappeared with the fall of temperature, a reappearance was noted with the onset of a relapse. Of special interest is the fact that in a certain number of cases bacilli were found during the brief post-typhoid elevations of temperature of twenty-four or forty-eight hours' duration. As a general rule, the bacilli were more numerous in the severer cases.

The author concludes that blood cultures constitute our most important diagnostic method in typhoid fever. Positive results may be obtained much earlier than by the Widal test, while a negative bacteriological blood examination in very ill patients with high fever where the clinical symptoms do not allow of a positive diagnosis practically excludes the diagnosis of typhoid.

The estimation of the number of the colonies is of a certain prognostic value.

In conclusion the author insists upon the fact that typhoid fever must be regarded as a general infection, pointing out the fact that the frequency with

which the bacilli are found in the circulation is really greater than in other conditions (puerperal sepsis, ulcerative endocarditis, etc.) which are generally so recognized.

While the usual portal of infection is probably the gastro-intestinal tract, the local lesions produced at the point of entry may, in some instances, be slight. In other cases it is possible that, as in some streptococcus infections, the processes may remain local, being arrested by the lymphatic apparatus of the intestine and the retroperitoneal glands. In most cases, however, the parasites pass "the protecting wall of the mesenteric glands," causing a general infection of the lymphatic system and the blood just in the same manner as a general infection occurs after wound infection. By the blood the bacilli are distributed throughout the organism, producing more or less characteristic manifestations. The author is inclined to even believe that the tendency toward involvement of the intestinal lymphatic apparatus is not necessarily the result of the fact that the intestine is the ordinary portal of entry, citing in support of this view the involvement of this system in relapses where it is much more reasonable to believe that the renewed infection springs from depots within the organism and from the intestinal tract as well as the fact that many areas far apart are so often simultaneously affected. He is inclined rather to assume that the intestinal follicles have a special predisposition toward infection with the typhoid organisms even when present in the general circulation.

[These latter theories have much in their support. If the general medical public only realized the fact that typhoid fever is clinically a general septicæmia, of which the intestinal changes form the more marked local manifestations, and not an intestinal disease, the senselessness of attempts at aborting or influencing this malady by so-called intestinal antisepsis would be more readily appreciated.—W. S. T.]

A Case of Typhoid Fever without Intestinal Lesions.—BLUMENTHAL (*Deutsche med. Wochenschr.*, 1902, xxviii. 626) from Stadlemann's clinic, in Berlin, reports the case of a woman, aged twenty-three years, who entered the hospital on the tenth day of typhoid fever. She was at that time five months' pregnant. The symptoms were characteristic; well-marked roseola and Diazo reaction were present, while the Widal reaction was positive at a dilution of 1/150. On the fourteenth day the patient aborted, and on the twentieth, died. At autopsy there was a hemorrhagic enteritis of moderate degree in the jejunum. In the lower part of the ileum the follicles were a little prominent; no affection of Peyer's patches. The ileocæcal glands were enlarged, on section, soft and grayish red, with prominent follicles; the spleen was large and soft. Cultures from the spleen and glands showed numerous bacilli answering to all the characteristics of the typhoid organism.

[This case emphasizes again the fact that the essential symptoms of typhoid fever are not dependent upon the intestinal lesions, but rather those of a general septicæmia with certain special characteristics.—W. S. T.]

Further Observations on the Relation of Changes in the Pancreas to Diabetes.—WEICHSELBAUM and STENGEL (*Wiener klin. Wochenschr.*, 1902, xv. 969) contribute an interesting discussion to this important question.

After considering the important contributions of Opie, Herzog, Wright and Joslin, Schmidt, von Hansemann, Ssobolew and Schultze, they discuss seventeen observations which they are able to add to their eighteen previously reported. Two of these cases were instances in which, clinically, the condition was regarded not as pancreatic diabetes, but as glycosuria of other origin. In the other fifteen cases the islands of Langerhans were found on necropsy to be diminished in number in every instance; sometimes so markedly that in large sections none could be found, while those islands which remained showed not only diminution in size, but "constant, definite, unmistakable changes." These were of three types: (*a*) Simple atrophy; (*b*) vacuolization or liquefaction; (*c*) an increase in connective tissue. In three cases hemorrhage into several of the islands was found, while twice marked deposition of fat granules, especially limited to the islands, was made out. These changes in the islands cannot, in all instances, be secondary to sclerotic changes elsewhere in the pancreas.

The proper interpretation of these observations and those of the authors previously noted is discussed at some length. v. Hansemann, an opponent of the theory that disease of the islands of Langerhans stands in direct causal relation to diabetes, noted that in 34 cases they were never wholly absent, while in only 6 was a sclerosis to be made out. But this argument is hardly sufficient in view of the mass of observations which have been accumulated; for the absence or disease of the majority of islands might well seriously injure their function, while, if one were to suppose that a total destruction alone resulted in diabetes, it would be difficult to explain the frequent improvements or recoveries which are seen. v. Hansemann himself observes that he has never seen a sclerosis of the islands without diabetes. It must be remembered, too, that sclerosis is by no means the only or even the commonest change which is found in the pancreas of diabetics. The authors conclude that there is much in favor of the theory that on the one hand Langerhans' islands play a most important rôle in the metabolism of the carbohydrates, while, on the other hand, pancreatic diabetes may result from a disease of these islands. Their conclusions are as follows:

1. In all cases of pancreatic diabetes, excepting those which they have clinically ruled out as not belonging to this class, they have found constant definite changes in the islands, changes sufficient to impair or destroy their function. These changes are not present in non-diabetics. In the non-diabetic atrophy of the pancreas in general marasmus they were able to make out a marked thinning of the epithelium, but neither liquefaction, destruction, nor diminution in the number of the islands.

2. The authors quoted above have found in all or in a considerable majority of their cases similar or like changes.

3. In these cases of pancreatic diabetes the remaining pancreatic tissue shows no changes or, at all events, alterations which are appreciably less marked than those of the islands, and are of a nature which from the experimental investigations of von Mehring and Minkowsky would have been insufficient to cause diabetes.

4. Those cases of glycosuria in which no changes in the islands have been found, admit always of an explanation which is reconcilable with the above-mentioned theory.

5. The histogenesis and structure of the islands make it probable that they have a wholly different function from that of the true gland parenchyma of the pancreas.

6. The experimental observations of Ssobolew, Schultze, as well as one of their own cases, show that the islands behave in an entirely different manner toward the agent producing pancreatic diabetes than toward those poisons which produce the other forms of pancreatic atrophy.

[These observations wholly confirm those of Opie demonstrating the remarkable—very probably causal—relation between disease of the islands of Langerhans and diabetes. It must, however, be remembered that, as Opie has pointed out, there are instances of diabetes in which no changes in the pancreas are demonstrable—and it must be acknowledged that we have as yet no methods for recognizing these two classes of cases clinically.—W. S. T.]

Eosinophilia in Filariasis.—CALVERT (*Johns Hopkins Hospital Bulletin*, June, 1902, p. 133), in studying the blood in four cases of filariasis in natives of the Island of Luzon, P. I., found that there was a quite marked eosinophilia in all cases. His attention was drawn to the possibility of an eosinophilia occurring in filariasis by the finding of enormous numbers of eosinophiles in the tissues surrounding the lymph vessels and in the bloodvessels of a patient who died of plague, but who was found at autopsy to have filariasis. Subsequently three cases were studied clinically, and an increase of the eosinophiles found in all. The highest eosinophile count was 22 per cent. In all the cases there was also a leucocytosis. An interesting point brought out was that the eosinophilia was most marked at the time of the day when the peripheral circulation was free from embryo filariæ. The leucocytosis and eosinophilia are apparently present only in the early stages of the disease, both disappearing in chronic cases.

The Etiology of the Summer Diarrhœa of Infants; A Preliminary Report.—A short time ago it was noted in this department that Vedder and Duval had investigated isolated cases of dysentery in the Philadelphia hospitals, as well as epidemics occurring in institutions in Lancaster County, Pennsylvania, and at New Haven, Connecticut. They had found, as a result of their study, that the dysentery was produced by *bacillus dysenteriæ*, the same organism that had been isolated from cases of acute dysentery in adults by Shiga in Japan, Flexner and Strong in the Philippines, Kruse in Germany. They seemed justified in concluding that this organism was the cause of acute dysentery the world over.

DUVAL and BASSETT (*American Medicine*, September 13, 1902, p. 417) have just made a preliminary report on their bacteriological studies of the cases of summer diarrhœas of infants admitted to the Thomas Wilson Sanitarium, near Baltimore, Maryland. They isolated *bacillus dysenteriæ* Shiga from the stools of forty-two of these cases. The organism was also found in the scrapings of the intestinal mucosa, and in one case from the mesenteric glands and liver. From an etiological and therapeutical standpoint this important discovery places the summer diarrhœa of infants on the same basis with the acute dysenteries of adults.

SURGERY.

UNDER THE CHARGE OF

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The Treatment of Prolapsus Ani of Children by Injections of Paraffin.—KAREWSKI (*Centralblatt für Chir.*, 1902, No. 28) states that the best results are to be obtained by injections of hard paraffin with a melting point of from 56° to 58°. The technique is as follows: For two days before the operation the bowels are to be well moved by artificial means, and on the afternoon previous to the operation 2 gr. of bismuth are given to induce constipation. The region of the anus is rendered as aseptic as possible and then the prolapse is reduced. A ring of the paraffin is then placed in the rectum above the anus between the skin and the mucous membrane. By means of diet and additional doses of bismuth the bowels are prevented from moving for the next twenty-four hours. Eight children (varying in age from two to eight years) were treated by this method and with success in every case but one, which came to the table not properly prepared. In no case was there infection, and the results are thoroughly satisfactory.

Twenty-one Cases of Gastro-enterostomy for Intrinsic Stenosis of the Pylorus.—CAIRD (abstract in *Medical Press and Circular*, May 28, 1902), in a paper read before the Edinburgh Medico-Chirurgical Society, says:

In dealing with the indications for gastro-enterostomy it was pointed out that they were in the main similar to those for gastrostomy, namely, difficulty in the onward passage of food, vomiting, progressive emaciation, and subnormal temperature. When these were present operation could not be delayed without serious risk. He held that it was erroneous to say that gastro-enterostomy was in itself an operation of great danger and of doubtful value in so far as prolonging life was concerned. Even if life were not prolonged by it, the patient at least did not die of starvation, his discomfort was lessened, and pain might be completely removed. Even in undoubtedly malignant cases there was sometimes so great a gain in weight after the operation as to call the diagnosis in question, for a time at least. Moreover, in some cases the tumor entirely disappeared after gastro-enterostomy. Of his twenty-one cases only one was said to be simple—a stricture due to gastric ulcer, and at the operation the diagnosis was confirmed. In only one case was no tumor to be felt. The principal symptoms were vomiting, emaciation, and absence or diminution of free hydrochloric acid after a test-meal. On the whole, the speaker preferred a posterior gastro-jejunostomy as close

to the duodenum as convenient, or in the complicated cases an anterior operation. The choice of a method was largely determined by what was found on opening the abdomen and to what extent the stomach remained mobile. He did not think that it made much difference whether the food current was isoperistaltic or antiperistaltic. No special preparation of the patient was required; unless the patient was accustomed to it, lavage was not practised. If the general condition was poor, teaspoonfuls of warm milk and water were given on the evening of the operation, and a small dose of morphine if there were pain or restlessness. On the morning succeeding operation, if there were eructations, vomiting, or quickened pulse, the stomach was washed out, a procedure from which Mr. Caird had seen nothing but good, although one must be prepared for, and guard against, syncope. If the pulse still remained rapid after lavage, then thirty ounces of saline solution should be transfused; this often gave markedly good results. Of his twenty-one cases four proved fatal; one patient died of bronchopneumonia and congestion of the kidneys, the abdominal wound remaining healthy; a second patient died from exhaustion, and a third from leakage through the wound in the stomach; in a fourth case fatal peritonitis ensued, probably from aërial infection.

Of the seventeen patients who survived the operation three had been lost sight of, and were probably dead, six were certainly dead, three from extension of the disease, two from cardiac failure, and one from phthisis; while eight patients were alive at periods extending up to six years after operation. A second laparotomy had been performed on two—in one for ventral hernia, and at the operation no trace of the old tumor could be found; in a second for nodules in the cicatrix, and here again the abdomen appeared free from disease. It might be asked whether cases which survived for six months were really malignant, but while the difficulty of differentiating simple hyperplasia from carcinoma might be extreme, it was hardly possible that experienced physicians could be so frequently in error about cases which showed all the clinical features of cancer. It was impossible to ascribe the great improvement in the patients to laparotomy alone, though Strüdel and others had reported improvement in abdominal cancer after simply opening the abdomen.

Lumbar Puncture as a Method of Treatment for the Sequelæ to Fractures of the Skull.—ROCHARD (*La Presse Méd.*, April 30, 1902), states that the constant presence of blood in the cerebro-spinal fluid shows that a fracture of the skull is present, but it is to be remembered that blood is also found just after a severe cerebral contusion. The diagnostic value of lumbar puncture is slight in comparison to its value as a therapeutic agent. It has been found to be particularly valuable in those cases of cerebral concussion where the resulting hemorrhage has not only caused mechanical pressure, but where, in addition, it has acted as a foreign body and caused a leucocytosis which markedly increased the tension of the cerebro-spinal fluid. Its value has also been well shown in those cases of chronic meningo-encephalitis in which, in addition to the trouble with the mentality, there is marked headache which is so severe as to render life almost intolerable. This headache is not relieved by any other method of treatment, but quickly disappears after the withdrawal of a varying quantity of the fluid.

Spinal Anæsthesia.—RACOVICEANO-PITESCI (*Bull. et Mem. de la Soc. de Chir. de Bucarest*, December, 1901) reports briefly 406 cases operated on under this method of anæsthesia without a death. A solution of from 1 to 2 cg. of cocaine, made up with cerebro-spinal fluid which had previously been withdrawn by puncture, was used in all the cases. Although there have been no fatal cases the author has observed nearly all the unpleasant sequelæ, such as headache, etc. The method has proved satisfactory, but should not be used in the presence of contraindications. Sequen in his last series of cases reports two deaths. In one there was an incarcerated hernia with the phenomena of septicæmia, while in the other arterio-sclerosis was present.

In the discussion which followed Jonnesco stated that he has used the method in only eight cases, and in one of these with a fatal result; no arterio-sclerosis nor organic lesions were present, and death was attributed directly to the cocaine. The author has abandoned this method, for the reason that its mortality is higher than ether or chloroform, and the after-effects, as a rule, are severe.

Sevrieana stated that he had used the method in thirty cases with one death, and in his hands it had proven in every way unsatisfactory.

Cicatricial Stenosis of the Pylorus.—QUENU and PETIT (*Revue de Chir.*, No. 2, 1902), after reporting in detail the results obtained in thirty-five cases operated on by different methods, state that the mortality in this series was 22.8 per cent. Considering this result more in detail, they show that three cases were treated by dilatation of the pylorus, with one death and two failures. In four cases resection of the pylorus was performed, and each time the operation was a success. Twenty-three cases were treated by pyloroplasty, with five deaths, or a mortality of 21.7 per cent. In seven cases gastro-enterostomy was performed, with two deaths, or a mortality of 28.8 per cent. In view of these immediate results, it would seem that the operation of resection is the best one, as having the least mortality; but it should be remembered that this method was used in the very small number of four cases. Closer examination of the five fatal cases of pyloroplasty shows that death in four cases was caused by shock, and in one case by gangrene of the lungs. The two fatal cases of gastro-enterostomy died of infection, but it should be remembered that these cases were operated on in the years 1884 and 1885, at which time the technique of this operation was not as perfect as it is at the present day. In looking at the subsequent history of all the operative cases one finds that all the cases of resection remained cured, but in no case were they under observation for more than five months after the date of operation. Of the cases operated on by pyloroplasty three died subsequently of pulmonary tuberculosis. The autopsy in each case showed that the new pylorus had maintained its normal dimensions. This observation is of the utmost importance, as it shows that the operation of pyloroplasty is sufficient to maintain the normal gastro-intestinal circulation. One case was in perfect health two years after the operation, but in all the other cases except three the patients had had some gastric trouble subsequently. Of the five cases of gastro-enterostomy four were under observation for a period of five months from the day of operation. Each of these cases was absolutely well during this time, and there was an entire absence of gastric phenomena. The

other successful case died two years and a half after the operation of tuberculosis, but during this time he was free from all intestinal symptoms. In view of all the facts the authors draw the conclusion that gastro-enterostomy is the best operation for the relief of stenosis of the pylorus. The posterior operation, with sutures, is the operation of choice. In a small number of cases gastro-enterostomy is contraindicated. These cases are where the stomach itself has been much altered by the swallowing of a caustic fluid and is small and shrivelled up. In one such case Hartman performed duodenostomy.

THERAPEUTICS.

UNDER THE CHARGE OF

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Suprarenal Extract in Eye Diseases.—DR. G. E. DE SCHWEINITZ states that suprarenal preparations are valuable: 1. To relieve hyperæmia of the conjunctiva when this is caused, for example, by local irritation, nasal catarrh, hay fever, eyestrain, etc. Under these circumstances adrenalin is particularly valuable and may be employed in very dilute solution; for example, 1 drachm of the 1:1000 solution in 2 ounces of distilled water, with 10 grains of boric acid. 2. To relieve the congestion, irritation, and lacrymation of ordinary conjunctivitis and to combat blepharospasm. 3. To relieve Fruehjahrs' catarrh, on which these substances have a marked curative effect. 4. To relieve trachomatous pannus and various types of vascular keratitis and scleritis, repeated instillations under these circumstances reducing the vascularization and allowing the tissues a chance to recover. 5. To enhance the action of cocaine, eserine, and pilocarpine by promoting their absorption. The adrenalin preparations are first used and followed, during the period of blanching, by the drugs named. 6. To reduce the tension of glaucoma. 7. To facilitate the introduction of lacrymal sounds, the preparation being first injected through the canaliculus. 8. To relieve ciliary pain in all forms of keratitis, iritis, and cyclitis with glaucoma. 9. To modify and even clear up certain opacities of the cornea, for example, those which follow contusions and even the opacities in syphilitic iritis. 10. To produce a cosmetic effect.—*Therapeutic Gazette*, 1902, vol. xxvi. p. 433.

Adrenalin in Genito-urinary Diseases.—DR. A. VON FRISCH has employed adrenalin in the form of three to five ounces of a 1:10,000 solution in the bladder for cystoscopic cases where there is liability of hemor-

rhage, and in most cases clear pictures were obtained. For operations for the removal of vesical tumors through suprapubic incision the bladder was treated with a 1:1000 solution, and the entire tumor with its base could generally be removed without the slightest hemorrhage; but, since a dilatation follows the constriction, the raw areas must be carefully cauterized if they are not approximated by suture. Adrenalin is also of great value in urethral stricture and prostatic hypertrophy where sounding and catheterizing are difficult, since a shrinkage of the mucous membrane will follow and the canal will materially widen.—*Wiener klinische Wochenschrift*, 1902, No. 31, S. 787.

Therapeutical Properties of Lachnanthes Tinctoria.—Dr. J. A. Gardner has investigated the properties of the lachnanthes herb, which has been lauded as a specific for consumption. He finds it to consist largely of a resinous principle and some body which is precipitated by lead subacetate and is soluble in water. Further, so small a dose as a drachm of an aqueous solution of the material obtained by alcoholic extraction of the plant is sufficiently powerful to kill guinea-pigs, while doses varying from 12 to 35 minims of the same solution do not exert any inhibitory action upon the progress of tuberculosis, but rather seem to hasten it.—*Lancet*, 1902, No. 4115, p. 72.

Therapeutic Application of Sodium Cinnamate.—Dr. Gilbert Morgan says that the therapeutic application of the sodium cinnamate has been rendered practicable by the discovery that this salt dissolves in glycerin to form a clear solution which can be easily manipulated in the hypodermic syringe. This preparation is more reliable than the emulsions usually advocated, inasmuch as no alteration of the salt occurs. The solution is prepared by heating dry, powdered sodium cinnamate with the pure solvent at a temperature of 356° F., and in this way from 10 to 11 per cent. solutions are readily obtained. It is important that the salt should be finely subdivided in order to shorten the heating process, which might otherwise lead to decomposition of the glycerin. The glycerin is otherwise admirably adapted for subcutaneous use.—*Lancet*, 1902, No. 4115, p. 66.

Treatment of Tuberculous Laryngitis.—Dr. L. Réthi says that despite the apparently hopeless condition of patients suffering from tuberculous laryngitis there is much that can be done for them to alleviate their suffering. The remedies generally employed for tuberculosis are in place, especially since the affection of the larynx is, in by far the most cases, secondary to pulmonary disease. As a broad statement it may be said that the prognosis is fair if the patients still are robust and without fever, if the process in the lungs is not far advanced, and if the changes in the larynx are circumscribed and without tendency to spread along the surface or into the depths. In small ulcers, cicatrization may result after the use of 60 to 80 per cent. of lactic acid, with or without previous scarification. The use of the single or double curette is often followed by success, the reaction being, as a rule, but slight. Galvanocautery also has its advantages, the sharp point being introduced into the infiltrated areas during intervals of ten days. This

may be supplemented by the application of trichloracetic acid. It is important to individualize and not to use radical measures in advanced cases, but, exceptionally, severe cases will heal and mild cases will advance. Where a cure cannot be hoped for, the treatment must be limited to the inhalation of disinfectants and the application of cocaine for pain. Where swallowing is difficult, food must be taken in the horizontal position with hanging head, and asphyxia may make a tracheotomy necessary.—*Centralblatt für gesamte Therapie*, 1902, Heft viii. S. 449.

Camphor in Morphine Habit.—Dr. J. Hofmann states that in many respects the physiological actions of morphine and camphor are diametrically opposed, and this has led him to try the latter in chronic morphine poisoning, with the astonishing result that the usual severe symptoms on withdrawing the drug were almost entirely missed. Not only was there a decided antagonistic action, but sedatives, such as trional and dormiol, were found to act much better with camphor than when given alone. The treatment is supplemented by the use of validol and electric baths, and there is no danger of causing either camphor or validol habit.—*Therapeutische Monatshefte*, 1902, Heft vii. S. 331.

Treatment of Early Mental Cases.—Dr. F. S. Toogood states that many, especially functional, mental diseases are made worse by improper management in the early stages, especially when one considers that temporary insanity may disappear after a few days of proper treatment, such as by the removal of abdominal tumors, or by the cure of various bodily affections, or alcoholism. The latter is the most frequent single cause of this type of insanity, and its most familiar forms are delirium tremens and dementia, which may be completely cured in from one to six months. Mania may have its origin directly in alcoholism or may develop subsequently to delirium tremens or dementia. Many sensory disturbances are also common. The author's confidence in the curability of most of these cases has led him to request the authorities to permit hospital rather than asylum treatment, since the stigma of having been in an insane asylum reacts upon all by preventing permanent and lucrative employment in man and marriage in woman.—*Lancet*, 1902, No. 4115, p. 76.

Persistent Hiccough.—Dr. William McDonald says the essential feature of persistent hiccough is sudden, involuntary contraction of the diaphragm. Simultaneously there is closure of the glottis, producing the characteristic sound. As to the predisposing condition, it can be said that any case in which there is increased general nervous irritability might be easily complicated by more or less persistent hiccough; that any local disorder which might extend to or become contingent upon any portion of the phrenic, its centres, or immediately related afferent nerves, such as the gastric branches of the vagus, may be said to offer special liability; that abnormal conditions in certain distant parts may constitute a predisposition; finally that, inasmuch as every reflex act prepares the way for its own repetition and that nerve force expends its energy along paths of least resistance, each attack intensifies the predisposition. Of the general conditions, hysteria and

neurasthenia are the most common; of the local, pre-existing inflammations of the pleura or peritoneum are the most frequent; of those acting reflexly, diseases of the organs of digestion and generation make up a large number. Alcoholism also constitutes a large proportion. The attacks vary very much; they may be continuous or intermittent and in some considerable exhaustion follows. The outcome of any given attack depends upon the gravity of the exciting cause. The list of remedies proposed is legion, but in all cases rational treatment must be directed to the cause, and if this cannot be discovered, measures which have an improving effect upon the whole economy are to be advised.—*Albany Medical Annals*, 1902, No. 9, p. 471.

Xeroform in Gastric Ulcer.—Dr. Dieninger has noted the rapid healing which is seen in all wounds of the skin when treated with xeroform. This has led him to try the drug in a marked case of gastric ulcer presenting all the typical symptoms, especially since it is known to rapidly and effectively coat all surfaces deprived of their epithelium. Four times daily seven grains were given in a wafer, and at the same time an ice-bag placed over the epigastrium and nutrition kept up by means of enemata. Very soon the tenderness disappeared, vomiting ceased, and the general condition improved from day to day, so that the author makes use of the highest words of praise.—*Allg. medicinische Central Zeitung*, 1902, No. 61, S. 719.

Anusol in the Treatment of Hemorrhoids.—Dr. John Moir remarks that in the case of patients suffering from piles, whether newly formed or chronic in character, whether small or large, even up to large venous knots hanging from the rectum and at times bleeding profusely, the medical man has found himself, as a rule, much handicapped in their treatment, owing to the want of any thoroughly reliable method to satisfy the exigencies of the patient The entire question of the treatment of hemorrhoids can now, however, be summed up in one sentence: Procure regular passage from the bowels. This object can be thoroughly obtained by the regular, systematic use of anusol suppositories. In the event of a threatened relapse, the further use of two or three suppositories will be indicated.—*The Therapist*, 1902, vol. xii. p. 104.

Value of Sulphur Baths.—Dr. Karl Ullmann emphasizes the value of sulphur baths in two conditions: Superficial diseases of the skin, and deeper, chronic affections of the fasciæ, joints, and muscles. Plain baths, no doubt, have an equally sedative action; yet experience has shown that syphilitics improve more rapidly if they take their inunctions at a watering-place where sulphur baths abound than at home or in localities where the water is indifferent or contains iodine. It seems as if the suspended sulphur or the sulphuretted hydrogen creates a tolerance in the skin which increases absorption and prevents the development of furunculosis. At all events it is a well-known fact that baths can be kept up much longer in sulphur than in other waters. It has been urged from many sides that sulphur and mercury are really incompatible since leading to the formation of insoluble sulphide of mercury, but it has since then been shown that if this were to be rubbed into the skin, it could produce ptyalism as well as the ordinary ointment.

Much has been said in favor of sulphur waters taken internally, and they could here be well dispensed with.—*Centralblatt für die gesamte Therapie*, 1902, Heft. vii. S. 385.

Yeast as a Remedy.—Dr. Heinrich Paschkis has carefully examined the action of yeast in fermentation, and states that it is hard to understand how it acts deleteriously upon the cocci which underlie the disease. There is certainly no direct action of the plant cells, nor can the minute quantities of alcohol formed be held responsible, and it seems as if by the presence of yeast abnormal processes in the alimentary canal are corrected and a cure thus brought about. Other conditions for which yeast is employed are anthrax, axillary adenitis, phlegmonous acne, and certain cases of sycosis. After-effects are acid eructations and diarrhœa. Certain writers have seen good effects in diabetes and diseases of the pancreas. The proper dose is seventy-five to one hundred and fifty grains daily in one to three doses with the chief meals. The different preparations vary considerably in strength.—*Wiener klinische Wochenschrift*, 1902, No. 31, S. 791.

PEDIATRICS.

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The Management of Infectious Diseases in Paris.—Ruhrah (*Pediatrics*, June 15, 1902, p. 449) reviews briefly the interesting investigations of Graucher concerning the transmission of infectious diseases as observed in his wards at the Hôpital des Enfants Malades.

Reasoning that antisepsis with isolation of the patient should give the best results in preventing the transmission of infectious diseases, Graucher began experimenting about 1888, and has finally evolved a system of hospital control that should be carefully studied by all those concerned in the management of hospitals for infectious diseases.

The leading principles of Graucher's system are contained in this dictum: Air infection does not exist where the patient does not expectorate and where dust is suppressed; on the contrary, infection is by infected objects—that is to say, by contact, direct and indirect. In order to avoid infections it is necessary to purify immediately the hands and objects soiled by contact necessary in the examination and care of the patient, and, secondly, to diminish contact with children with infectious diseases and with those supposed to be infected.

In the management of the ward the first care is the suppression of dust. To maintain this the floors are paraffined and are washed twice daily with a solution of sublimate. The walls are painted and are washed twice a week with sublimate solution. The second care is the isolation of the patient. A metal screen, 1.25 metres high, surrounds the bed. One end is left open, so that it may be entered. On entering the screen both physicians are gowned, and on leaving the hands are disinfected by washing with soap and brush, followed by the use of a 1:1000 sublimate solution. The gowns for each patient are hung on the screens of the respective beds. All mattresses and bedding are sterilized by steam, and all the linen and articles used for feeding are boiled in water. The food is served on wire trays. After the meal the napkin and feeding utensils, with the tray, are placed in a pot of water with a little carbonate of sodium and boiled for five minutes. The beds are of iron, and are disinfected by scrubbing with an acid solution of sublimate.

Infectious cases developing in the ward are not removed, but are treated in the same room with the other cases, and the same nurses handle both the infectious and non-infectious cases. All of them are obliged to take the same rigid precautions. A number of infections could be directly traced to importation by visitors. In order to avoid the introduction of contagion by new cases, all new cases and newly admitted patients are regarded as suspects, and are isolated behind screens just like the contagious ones. If at the expiration of twenty days they have not developed any infection they are released.

The results of this system of caring for contagious cases are very significant. Previous to the change an average of 36 cases of measles developed in the wards; during the decade following, under the special precautions, the annual average was reduced to 11. With varicella, about the same result was shown. With diphtheria the results were very remarkable. Previously there had been an average of 12 infections yearly in each of two wards. Afterward, during the next ten years, in one ward there was not a single case of infection, and in the other there were only 6 cases, 5 of which were imported by visitors. Cases occurred in the wards during this period, but they came in either as developed cases or during the stage of incubation. Of the other infections, scarlet fever was practically controlled, and whooping-cough, mumps, and bronchopneumonia were practically entirely suppressed.

Tetany and its Relation to Cow's-milk Feeding.—FINKELSTEIN (*Bulletin Médicale*, 1902, p. 683) presents some interesting features in connection with latent tetany, a condition characterized only by electrical hyperexcitability of the nerves and muscles (Erb's sign). He has observed that this hyperexcitability, with or without other symptoms of tetany (laryngospasm, Trousseau and Chvostek phenomena), exists in 30 per cent. of all infants fed on cow's milk, but is never found in breast-fed infants nor in those fed upon farinaceæ, broths, and eggs. In the latter class Erb's sign may be obtained if the serum of cow's milk is administered. From this he concludes that the substance which produces tetany is not in the casein or in the fat, but in the serum. On the other hand, the author has been able to convince himself that with an infant affected with latent tetany the neuromuscular

hyperexcitability disappears or notably diminishes when the cow's milk is replaced by breast feeding or by farinaceæ and eggs.

From these facts Finkelstein concludes that under the influence of cow's-milk feeding one frequently sees develop, by a mechanism yet to be elucidated, a disturbance of metabolism manifested by a more or less active neuromuscular hyperexcitability, with or without the phenomena of a frank tetany. These symptoms are due to a defective assimilation or transformation of an unknown principle, found in the milk of the cow, which is also, perhaps, formed at the expense of a regressive metamorphosis of the infant's own tissues. The variability of the relation between these two pathogenic factors of tetany is the reason for the variable effect produced by substituting another kind of alimentation for cow's milk—whether it suppresses completely the neuromuscular hyperexcitability or reduces it partially, or not at all. This substance appears not to exist in vegetables, eggs, or meat broths.

A New Sign of Tetany.—SOLOVIEFF (*Rousski Vratch*, 1902, No. 26) has observed two adolescents suffering from tetany, who, in addition to the Trousseau and Chvostek phenomena, presented quite violent rhythmic contractions of the diaphragm. These were perceptible to both inspection and palpation, synchronous with the cardiac systole. At the same time a feebly-whistling sound is heard, which is produced by the penetration of a certain quantity of air into the left lung, sharply inflated at each contraction of the diaphragm. These spasmodic contractions, which can be verified by radiographic examination, are produced, in the author's opinion, by a direct irritation of the phrenic nerve (in a state of hyperexcitability) by the movements of the heart. They cease only during effort and deep inspiration. This new sign of tetany Solovieff proposes to designate by the term "the phenomenon of the phrenics."

The Supposed Infectivity of Desquamation in Scarlet Fever.—C. KILLICK MILLARD (*Lancet*, April 5, 1902) discusses the subject of the infectivity of desquamation in scarlet fever, and believes that there is not sufficient evidence at hand to justify the general opinion that the desquamated cuticle of scarlet fever is infectious *per se*. After consultation with numerous physicians connected with fever hospitals throughout England, he finds them quite uniformly agreed that (1) they can adduce no evidence that the desquamating epithelium is *per se* a source of infection; (2) they consider that too much importance has been attached in the past to desquamation as a source of infection; (3) their experience does not support the popular view that desquamation after scarlet fever is necessarily an indication that a patient is still infectious; (4) they believe that a patient may continue to desquamate for some time after he has ceased to be infectious; and (5) they do not believe that it is necessary, in order to prevent the spread of infection, that patients who otherwise are quite ready to leave the hospital shou'd be detained until every visible trace of desquamating epithelium has disappeared.

The writer questions the supposition that the flakes of epithelium from scarlet fever contain the germs of the disease in the same way that the pustules and scabs of smallpox are believed to do. The eruption, being an

erythema, is a process characteristic of chemical poisoning or of poisoning by the chemical products of microbic action rather than of the direct action of microbes themselves. Thus it is quite analogous to the erythematous rashes caused by the use of certain drugs and by septic absorption, these erythemata being often followed by desquamation. Desquamation much more profuse than that seen in scarlet fever follows the eruption of erythema scarlatiniforme desquamativum, yet there is no reason to think that the process in any of these cases is a microbic one.

The writer has endeavored in a small way to collect statistics by observing whether patients discharged from hospitals while still desquamating, though otherwise apparently free from infection, were more frequently followed by "return cases." Of 2500 cases discharged, 8 per cent. showed some trace of desquamation; but of the cases which carried out infection (by giving rise to "return cases") only 6.5 per cent. had been noted as showing traces of desquamation. In the absence of bacteriological evidence, it appears that the only way in which this question can be settled is by specially collected statistics.

GYNECOLOGY.

UNDER THE CHARGE OF

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Vesicovaginal Fistula.—DREW (*British Medical Journal*, No. 2159) devised an ingenious method for closing a vesicovaginal fistula, one-half inch in diameter, due to the ulceration caused by a Zwanck pessary, and situated at the junction of the cervix with the anterior vaginal wall. An incision was made in the median line of the anterior vaginal wall from close to the urethral orifice to the margin of the fistulous opening; this incision was prolonged around the margin of the fistula. The vagina was then carefully separated from the bladder, and the two flaps thus made were drawn aside. A U-shaped flap of mucous membrane was dissected from the anterior lip of the cervix and accurately sutured, by Lembert's method, to the margins of the fistula. The vaginal flaps were united in the middle line and their upper margins sutured to the raw surface on the cervix. The fistula was permanently closed, and the vaginal wound healed well.

Vaginal Shortening of the Uterosacral Ligaments.—BOVÉE (*American Gynecology*, vol. i., No. 1) gives the following technique for shortening the uterosacral ligaments to correct retrodisplacements of the uterus: The patient is placed in the extreme lithotomy position, the perineum well retracted, and the cervix grasped with a volsellum forceps and drawn forward. A longitudinal incision, starting at the cervicovaginal junction, is made

through the structures of the posterior vaginal fornix down to the perineum. By careful dissection the ligaments are brought into view. The amount of shortening needed is decided upon, and one of the ligaments is grasped with forceps midway between the points to be united; the traction on the cervix is lessened and the ligament brought into the vagina. A curved needle armed with kangaroo tendon is then passed through the extreme points of shortening; another is passed through the loop thus formed and through the posterior portion of the cervix below the insertion of the ligament. The opposite ligament is similarly treated. The sutures are tied after they are all in place. The vaginal wound is spread well open, and the two ends of the longitudinal incision are approximated by suture, the remainder of the wound being closed as though originally a transverse incision.

Gonococcal Peritonitis.—FRANK and KOEHLER (*American Journal of Obstetrics*, vol. xlv., No. 3) report a case of septic peritonitis following operation for acute gonorrhœal salpingitis. The right tube was easily removed, but the left broad ligament was infiltrated and friable, so that the ligatures cut through the tissues, and a small amount of pus escaped during the removal of the left tube. The abdominal cavity was irrigated and drainage used. Peritonitis developed within twenty-four hours; death occurred seventy-two hours later. Bacteriological examination of the pus found in the pelvic and abdominal cavities showed on human blood serum a pure culture of the micrococcus of Neisser, this being the only organism found. This finding is in contradiction to the opinion of Bumm and Treves, that the gonococcus is only pathogenic when implanted on mucous membrane, and is soon destroyed in serous cavities unless there is a mixed infection.

[The report affords a strong argument for postponing radical operative interference in this class of cases until the acute symptoms have subsided and the organisms have become less virulent, unless the tubes become so distended that rupture is threatened, or a large pelvic abscess forms, when vaginal puncture and drainage is, as a rule, preferable to an abdominal operation.—W. E. S.]

Deciduoma Malignum.—LADINSKI (*American Journal of Obstetrics*, vol. xlv., No. 4) reports a case of deciduoma malignum, and reviews 132 cases collected from the literature on the subject. The clinical features which should aid in the diagnosis of the disease are summarized as follows:

A history of recent parturition or abortion, especially if a hydatid mole has been discharged or placental tissue retained; profuse hemorrhage occurring at irregular intervals without apparent cause and not amenable to the ordinary means of treatment, and which recurs in spite of repeated curettages; the presence of a constant sanguineous discharge during the interval of hemorrhage; a persistently large and hyperplastic uterus and cervix, with patulous os; pain in the pelvis; anæmia, rapid loss of flesh, and strength, and cachexia; characteristic nodules in the interior of the uterus in the early stage; the presence of metastatic deposits, especially in the vagina and lungs, the latter producing cough and bloody expectoration.

Owing to the rapid progress of the disease, the only treatment is complete

extirpation of the uterus, and vaginal metastasis, if present, as soon as the diagnosis is made from the clinical signs or the histological examination. This should be resorted to, even though metastatic deposits are found or suspected in other parts of the body, for in a few cases secondary deposits disappeared after the primary tumor was removed.

The author agrees with Newmann that the uterus should be extirpated whenever the microscopic examination of the cysts in a hydatid mole shows an atypical proliferation of the cells or the scrapings from the uterus show the slightest indication of malignant degeneration.

The Endometrium during Menstruation.—FINDLEY (*American Journal of Obstetrics*, vol. xlv., No. 4) confirms the observations of Gebhard regarding the changes occurring in the endometrium in menstruating uteri. Sections were made from uteri removed during the menstrual period for conditions other than disease of the endometrium. In one specimen removed twenty-six hours after the onset of the menstrual flow the capillaries, which are rarely visible in the intermenstrual period of the normal uterus, were found to be widely dilated; a serosanguineous exudate permeated the stroma, widening the intercellular spaces. These changes were more marked near the surface. The glands were not affected, and the surface epithelium was intact and apparently normal.

A second specimen removed on the third day of menstruation showed the "subepithelial hæmatoma" well marked. The surface epithelium was lifted from its bed by underlying blood; here and there the blood had burst through the epithelial covering and carried with it small bits of epithelium. Fatty degeneration of the mucosa was not in evidence.

In a specimen removed the day following the cessation of the menstrual flow the bloodvessels were less engorged than in the preceding specimens; the blood extravasated into the stroma was less in amount and did not have the appearance of fresh blood. The surface epithelium was intact and adherent to the stroma.

In none of the specimens were changes found in the tubes.

The Changes Occurring in Uteri in which Fibromyomatous Tumors Are Present.—E. S. BISHOP (*British Gynecological Journal*, Part lxviii.), after a careful study of microscopical sections from uteri in which fibromyoma were present, seems justified in drawing the following conclusions:

The presence of a fibromyomatous growth in the uterine tissue has an effect on the endometrium lining the uterus. In the early stages, and while still intramural, it tends to produce hyperplasia of the endometrium. When it becomes sufficiently submucous to exert some pressure upon the membrane it produces compression of the glands, with subsequent disintegration of both them and the interglandular substance. When actually polypoid into the uterine canal the endometrium over the tumor and the opposing uterine wall is reduced to a single layer of cells, which becomes progressively thinner in proportion to the pressure exerted, and approximates the squamous type. In many of the specimens examined bloodvessels and lymphatics were seen immediately below or within a very short distance of the protecting line of epithelium.

A further study of the sections seems to add weight to the theory that these tumors originate from the muscular coats of the smaller uterine arteries. The author states that the arteries in a uterus that has been the site of a fibromyomatous neoplasm do show changes in their structure differing from the normal; that these changes consist mainly of more or less hypertrophy of the muscular coat, and that it is perfectly possible that such hypertrophy, carried to a sufficient extent, might produce the masses or neoplasms known as fibromyomatous tumors.

Ultimate Results of Operations for Retroflexion and Prolapsus.—ANDERSCH (*Archiv für Gynäkologie*, Band lxv., Heft 2) tabulates 344 cases from the Breslau clinic, representing the results obtained in four and one-half years. He notes that while Pfannenstiel operated upon 28.6 per cent. of his hospital cases of uterine displacement, only 2.4 per cent. of his private patients were treated surgically.

The first series included cases of anterior and posterior colporrhaphy. Among 60 patients who were examined 50 were cured. In 37 cases vaginal shortening of the round ligaments was combined with colpoperineorrhaphy. Of 29 patients, 48.2 per cent. had a recurrence of the displacement.

Seventy-three cases of vaginofixation by Dührssen's method are included in the third series, but it was confined to women who had passed the age of childbearing. Fifty-four patients were examined, in only 7.4 per cent. of whom was the uterus retroverted.

In 44 cases of younger women the modified Dührssen's method was adopted —*i. e.*, the vesico-uterine fold alone was sutured; 12.5 per cent. of 32 patients examined subsequently had a recurrence.

Sixty-three cases of adherent retroflexion, with diseased or adherent adnexa, were treated by ventrofixation, a permanent cure being noted in 94 per cent. of the 50 patients examined afterward.

Commenting on these statistics, the writer notes that the results as regards the cure of prolapsus, as well as of retrodisplacement, were quite satisfactory, even in the first series, where the prolapsus was the main indication for operation. Although a recurrence of the cystocele was noted in only three cases, he admits that it must be expected to occur eventually in all working women unless the uterus has been fixed in a position of anteflexion. He believes that most cases of simple retroversion in nulliparæ and in a few women who have borne children are usually best treated by pessaries, or, if non-surgical treatment is unsuccessful, by Alexander's operation. That the latter has a limited field, in his opinion, is shown by the fact that he records only 9 cases, with 4 failures.

Although Pfannensteil adopts Dührssen's method in selected cases of movable retroflexion, he does not approve of the latter's practice of separating adhesions and removing diseased adnexa or neoplasms through the vaginal incision, but prefers the abdominal route.

Torsion of the Pedicle.—BÉRARD (*Gaz. des Hôpitaux*, 1901, No. 55) reports three cases. In the first he found a dermoid cyst, with purulent contents, which compressed the ureter, the patient succumbing twenty-four hours after operation. In the second case torsion of the pedicle of a cystic ovary

produced symptoms causing the writer to diagnose appendicitis. The usual lateral incision was made when the true condition was recognized. A median incision was then made, and the ovary was removed successfully.

In the third case a solid tumor of the ovary (cancerous) was removed with the uterus.

OBSTETRICS.

UNDER THE CHARGE OF

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Rapid Dilatation of the Cervix with Rossi's Dilator.—In the *Centralblatt für Gynäkologie*, 1902, No. 35, KNAPP adds his testimony to that of Leopold in favor of the use of Rossi's dilator. It will be remembered that this instrument consists of several arms over which are placed corrugated tips to secure a firm grasp of the tissue. These arms are separated by a screw turned by a small wheel at the outer extremity of the instrument. It is inserted within the cervix, closed, and its blades gradually separated until dilatation is complete.

Knapp's case is that of a patient, aged thirty-eight years, in a critical condition from extensive pulmonary tuberculosis. She was seven months pregnant, and the cervix admitted three fingers with difficulty. It was desired to empty the uterus as rapidly as possible in the interests of the child and with the hope of somewhat relieving the mother. In a little over ten minutes it was possible to completely dilate the cervix and extract the child with forceps. The fœtus had recently perished before extraction.

It must be remembered in judging of this case that in phthisical patients the tissues are often anæmic and relaxed, and hence dilatation would not be difficult. In spite of this, however, the action of this instrument is certainly remarkably efficient.

Two Vaginal Cæsarean Sections for Eclampsia.—JAHREISS (*Centralblatt für Gynäkologie*, 1902, No. 35) reports two cases in which vaginal Cæsarean section was practised, with version and extraction of the child, for eclampsia. The first of these was that of a primipara who had had twenty-three convulsions before she was seen. She had marked œdema, the pupils were very small, and the pulse full, hard, and rapid. The cervix was undilated, the head movable, and the membranes had ruptured. Vaginal Cæsarean section followed by version and extraction of the child were performed. Mother and child made a good recovery. In Case II. the patient had not been so long in eclampsia, but seemed much more prostrated and with much less power of resistance. The child was dead when the patient was admitted to the hospital. She was delivered by a vaginal Cæsarean section, with

version and extraction and separation of the placenta. The mother did not recover consciousness, and died of heart failure nine hours after delivery.

From the standpoint of those who believe that rapid delivery is imperative in eclampsia, the method of Cæsarean section by vaginal incision deserves careful attention. It has the advantage over abdominal section that the abdomen remains unopened, while version gives a ready method for the extraction of the child.

Myoma of the Uterus Complicating Pregnancy.—BACKER (*Centralblatt für Gynäkologie*, 1902, No. 38) reports six cases of myoma of the uterus complicating pregnancy.

The first case was that of a primipara who was delivered of a child at full term, labor being complicated by the presence of a myomatous tumor as large as a child's head. The tumor was fixed, immovable, its lower portion lying in the hollow of the sacrum and its upper border extending above the promontory. It was impossible to remove the tumor through the vagina or to so displace it that labor could proceed, and accordingly the abdomen was opened and the child extracted by incision of the uterus. The tumor was left. The patient's recovery was complicated by phlegmasia of the lower extremity, from which the patient made a gradual recovery. Nine months afterward the tumor had decreased one-half in size.

In two of these cases the presence of the tumor caused such dyspnœa that operative interference was undertaken during the second half of pregnancy. In the first of these the tumor was an intraligamentous growth upon the left side, and was successfully removed, pregnancy continuing. The second of these cases had the tumor behind the uterus, and the uterus and tumor were removed and the stump treated with the thermocautery. This patient died from purulent peritonitis.

Two other cases were those of pregnancy in the early months complicated by the presence of myomatous tumors. In each of these cases the uterus was emptied, and in each the patient made a good recovery from the operation. One of the tumors was a polyp which protruded from the uterus and became gangrenous.

His last case was that of a patient seen in consultation and found dying of septic infection. Upon examination it was found that a gangrenous myoma retained within the abdomen after the birth of the child was the cause of the infection.

Abdominal Section for Retroflexion and Fixation of the Pregnant Uterus.—At a recent meeting of the Obstetrical Society of Dresden, MARSCHNER (*Centralblatt für Gynäkologie*, 1902, No. 38) reports the case of a patient, aged thirty years, suffering from loss of appetite, vomiting, and pain in the back and abdomen. It was thought that she had tubal gestation. The uterus seemed to be small, the left ovary swollen, and the right could not be felt. A tumor was developing in the right side of the pelvis which was thought to be a tubal gestation. This tumor could not be moved under anæsthesia, and was possibly a retroflexed and incarcerated pregnant uterus. The patient was treated by abdominal section. It was found that the tumor was the retroflexed pregnant womb, which was fixed beneath the promontory of the

sacrum by numerous adhesions. The uterus was dislodged and restored to its normal position, and the patient's pregnancy continued to term.

Hebotomy.—Ven de Velde (*Centralblatt für Gynäkologie*, 1902, No. 37) has collected three cases by Italian operators in which the pubes have been severed at one side of the symphysis to enlarge the pelvis during labor. He adds to these three cases two of his own as follows:

Case I. was that of a patient in her second labor, aged twenty-eight years. She had had one child in spontaneous labor which was small and ill-developed, and which died shortly afterward. The patient had been in labor twenty-four hours without the engagement of the head. The contraction ring could be plainly distinguished between the umbilicus and the symphysis. The child was living, the membranes had ruptured, and the cervix was considerably dilated. The internal antero-posterior diameter was 8.5 cm., and the distance between the tuberosities of the ischia 10.5 cm. The patient was transported to a hospital, and under anæsthesia the cervix was dilated and version was attempted. This was abandoned because of the danger of the lower uterine segment. The patient was then put in Walcher's position and the operator endeavored to force the head into the pelvis, but this also failed. The child's heart sounds remained good.

Cæsarean section was declined because the discharge from the uterus had a distinct odor, and the patient's temperature was slightly above normal. The pelvis was opened by an incision upon the patient's left side at the spine of the pubes, extending slightly inward and beneath. Under the guidance of the finger, the chain saw was passed around the bone, which was very easily severed. There was slight bleeding, which was controlled by a tampon of iodoform gauze. The child was readily delivered by forceps, and proved to be above the average size and weight. It was slightly asphyxiated, but readily recovered. A slight rupture of the perineum occurred. The periosteum was brought together by buried sutures of silk, and the lower portion of the wound was drained by small pledgets of iodoform gauze. The pelvis was compressed by a firm bandage, and sand bags were laid upon each side of the pelvis after the patient had been put in bed. The patient recovered, with fever for a few days and with slight phlegmasia of the left side, which readily subsided. The stitches were removed on the seventh day, and a slight serous discharge persisted from the point of drainage for a short time afterward. When the patient got up the ends of the bones could be felt to rub together slightly, although a distinct callus could be appreciated on the anterior surface of the wound. The patient ultimately made a complete recovery.

Case II. was that of a patient, aged thirty-three years, who had been pregnant three times previously. Her pregnancies had ended in premature labor in two cases, with version and extraction of a dead child. In one instance she gave birth to a small child which did not survive. The patient had a strongly rhachitic pelvis, which also was much flattened. The internal antero-posterior diameter was 7.5 cm. On examination, the head was found above the pelvic brim, freely movable, and with the back directed toward the right side. Pains were becoming strong, the lower uterine segment was much distended and thin, and the uterus was painful to palpation. The patient was operated upon by the same method, and after the pelvis had been opened

the child was delivered by version and extraction. The pelvis was allowed to separate widely until the head had come into the pelvic cavity, when firm pressure was made upon both sides of the pelvis, and the lower extremities were strongly flexed. The child was delivered without difficulty. The uterus did not contract vigorously, and the placenta was immediately removed and the uterus tamponed with vioform gauze. The vagina was also tamponed. The wound was closed as in the previous case, and a permanent catheter placed in the bladder. The bowels were prevented from moving for several days after the operation in order that the patient should be kept as quiet as possible. The bladder was douched with boric acid solution. The gauze was allowed to remain within the uterus and vagina for five days. The patient made an excellent recovery.

Van de Valde believes that this operation furnishes a safe and most rational method of dealing with cases of moderate contraction of the pelvis. He believes that it is safer to sever the pubes at one side of the symphysis than to cut directly through the joint. He believes that a better union is obtained through bone than when joint surfaces are opened. While the number of his cases is too small to justify a positive conclusion, his experience and that of others is sufficient to draw attention to this method.

The Medical Indications for the Induction of Labor.—PINARD (*Annales de Gynécologie et d'Obstétrique*, September, 1902), in a paper under the above title, states that in his clinic during the ten years from 1890 to 1900 he has induced labor for cases other than pelvic contraction twenty times. The number of patients under observation during this time was 22,708. Fifteen of the twenty patients recovered and five died. When these cases are examined to determine for what conditions he would induce labor, we find that severe albuminuria, cardiac disease, hemorrhage with low attachment of the placenta, pernicious nausea, polyhydramnios, molar pregnancy, and eclampsia were the causes which justified the interruption of pregnancy. His method is that usually employed, consisting in the introduction of an aseptic bougie within the uterus.

The First Stage of Labor.—TWEEDY (*Journal of Obstetrics of the British Empire*, October, 1902) has studied the dilatation of the cervix during the first stage of labor, with special reference to rupture of the uterus. His conclusions, which are of practical interest, are as follows:

The first stage of labor begins when the polarity of the uterus is established. This condition results from overstretching of the nerves which pass through the lower uterine segment, distributed to the circular muscular fibres of the cervix. The painless uterine contractions of pregnancy thin out the segment and bring about this condition. The cervix may be fully dilated without being sufficiently open to permit the passage of the fœtus. The most usual cause of the elongation of the anterior lip of the cervix is a retraction of the posterior cervical lip and the dragging upward of the os. In these cases there is danger of rupture to permit an expansion sufficiently large to give exit to the child. Such a laceration cannot be sutured because of the unfavorable condition of the parts and the retraction of the posterior lip. In multiparous women tears of the cervix most often involve the vagina as well

PATHOLOGY AND BACTERIOLOGY.

UNDER THE CHARGE OF
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A Contribution to the Normal Histology and Pathology of the Hæmolymph Glands.—A. S. WARTHIN (*Journal of Medical Research*, July, 1902) discusses the histology and pathology of the hæmolymph glands. The essential feature of the glands is that they contain blood sinuses instead of lymph sinuses. The blood sinuses may entirely replace the lymph sinuses, or may occur with the lymph sinuses, in which case they belong to a mixed type. The hæmolymph glands are found most commonly in the prevertebral retroperitoneal region, usually near the great vessels, and less commonly in the mediastinal tissues. Very frequently they lie near the parathyroids. Microscopically, two distinct types are distinguishable: First, the splenolymph gland; and, second, the marrowlymph gland. The first form is the more usual, and may be mistaken for an accessory spleen. In this variety the sinuses, which besides red blood cells contain leucocytes, are lined by endothelium and reticulum, but the endothelium may be absent. The cells which make up the lymphadenoid tissue are small lymphocytes, large mononuclear cells, transitional and polymorphonuclear leucocytes, and rarely mononuclear eosinophiles and mast cells. Although the lymphadenoid tissue is often present in fair amount, it may be so much reduced in comparison to the blood spaces that the gland closely resembles the spleen. In the blood sinuses numerous large mononuclear phagocytes packed full of red blood corpuscles are seen, and pigment is present in large amounts. Warthin believes the chief function of these glands is of a hæmolytic nature, and that secondarily they are leucocyte forming organs.

In the marrow lymph glands the blood sinuses are filled with a coarse reticulum, through which the red blood corpuscles filter. Between the sinuses masses of lymphoid tissue are arranged in cords, in the pure type, there being no true follicles. Fat cells are scattered throughout the glands. Many varieties of cells are found in the lymphadenoid tissue; mononuclear eosinophiles and multinucleated cells as well as large mononuclear forms with knobbed nuclei are numerous; giant cells of the bone-marrow type are occasionally seen, and red blood corpuscles are common—none of them, however, being nucleated under normal conditions. Besides these various types of cells deposits of hyaline material occur frequently. In the blood sinuses, also, the cell forms are very varied and in much greater numbers

than in the splenolymph glands. Normally these glands are leucocyte forming, and play but a small part in hæmolysis.

Different pathological conditions may affect these glands, such as inflammation, congestion, carcinomatous metastases, and tuberculosis. The marrow lymph glands in pyæmia showed actively proliferating lymphocytes and many nucleated red blood corpuscles. In both secondary and pernicious anæmia hæmolysis is increased, but there is no new formation of red cells. The glands, however, from a case of anæmia gravis with hemorrhages showed both hyperplasia of the lymphoid tissue and actively segmenting red blood corpuscles and lymphocytes, thus suggesting that the tissue had assumed a portion of the bone-marrow function. Still more marked were the changes in a fatal case of anæmia following epistaxis, for not only were nucleated red cells present, but every type of bone-marrow cell was found. The same picture was again present in a case of splenomyelogenous leukæmia. After splenectomy in a case of splenic anæmia the microscopic appearance of the glands was practically that of the spleen. Finally, from his studies Warthin concludes that these glands are to be considered as compensatory structures assuming the function either of the spleen or bone-marrow should these organs be destroyed or become incapable of carrying on their own functions.—W. T. L.

The Influence of Alcoholic Intoxications upon Certain Factors Concerned in the Phenomena of Hæmolysis.—A. C. ABBOTT and D. H. BERGEY (*University of Pennsylvania Medical Bulletin*, August and September, 1902). The main problems dealt with in this series of experiments were:

1. The influence of alcohol administered per os upon the complement content of the blood of rabbits.

2. The influence of alcohol similarly administered upon the specific blood reactions of rabbits already artificially immunized against an alien blood.

3. The influence of alcoholization upon the process of artificial immunization by an alien blood.

In the first series of experiments the serum of rabbits immunized against bovine blood was used as a basis. After heating this serum varying amounts of fresh normal rabbit's serum and alcoholized rabbit's serum were added in order to ascertain the amount of each of these sera necessary to reactivate the heated immune serum. Much more of the alcoholized rabbit's serum than of the normal rabbit's serum was required to obtain hæmolysis—that is to say, the complement of the blood was definitely reduced in the case of the alcoholized rabbits, their serum containing roughly only about 50 per cent. as much complement as normal rabbit's serum. Control experiments showed that the reduction was not due to small amounts of alcohol in the serum or to a diminished alkalinity of the blood.

In the second series of experiments it became apparent that when alcohol was fed to animals previously immunized there resulted not only a reduction in the complement content, but also a reduction in the immune body of that serum. This was demonstrated by reactivating the heated serum of alcoholized artificially immunized rabbits with normal serum. Much more normal serum was needed to obtain hæmolysis with this serum than with the serum of control animals which had not received alcohol.

Finally all attempts failed to immunize rabbits, which had previously received alcohol, against alien blood. Some of the animals died after the first inoculation, others died after the second or third inoculation, but artificial immunity was not established in any case. This result agrees with the findings of Deléarde, Lactinier, and others. The authors explain it by the great diminution in the complement content of the blood brought about by the injection of alcohol. They conclude that:

1. The daily administration of alcohol per os to rabbits brings about a reduction in the circulating blood of hæmolytic complement.

2. Slight alterations in the normal alkalinity of the blood serum has no demonstrable influence upon the complement (hæmolytic) of the blood of alcoholized rabbits.

3. The diminished reactivating power of the blood of alcoholized rabbits is not due to the presence of small amounts of alcohol as such in the blood.

4. The administration of alcohol to rabbits induces not only a marked reduction in the complement content of their blood, but may cause at the same time a reduction in the specific hæmolytic receptor in the blood of rabbits artificially immunized against alien blood.

5. The diminished complement content of the blood of alcoholized rabbits renders the animal more susceptible to the toxic action by an alien blood.—W. T. L.

Guarnieri's Vaccine Bodies.—R. Romme (*La Presse Médicale*, May 3, 1902) in his review of the subject of vaccine bodies bases his belief in their specificity chiefly on the work of Wassielewski. Since 1894, when these refractile oval corpuscles were first described by Guarnieri, various explanations have been given of their meaning. Many have regarded them as products of degeneration either of leucocytes (Salmon) or cell protoplasm (Hückel), but the work of Wassielewski seems to have determined rather definitely certain points which tend to a belief that these corpuscles are parasitic and of a specific nature. In brief, this author has shown that these bodies are of constant occurrence in the epithelial cells in cases of variola and vaccinia, and occur in no other cutaneous infection; they can be reproduced by inoculating calf vaccine in the cornea of rabbits, and can be transmitted for many successive inoculations; and, finally, that no other pathological product or traumatic lesion will produce the bodies in the cornea.—F. P. G.

Researches on the Hæmolytic Properties of Human Blood Serum.—Carmus and Paguiez (*La Presse Médicale*, May 21, 1902, No. 41) reported, at a recent meeting of the Société de Biologie, interesting observations on the variations in the hæmolytic properties of human sera on rabbits' red blood corpuscles. In eleven out of fourteen cases they have found a direct parallelism between the degree of leucocytosis and the intensity of hæmolysis; in the other three cases the polymorphonuclear leucocytes alone were increased, with practically no change in the mononuclear leucocytes, which is of interest in its relation to Metschnikoff's idea that these latter cells alone produce the "macrocytase" or alexin capable of causing hæmolysis.

In twenty-four observations on the effect of human sera in various chronic

diseases on normal human corpuscles, in thirteen the blood was found hæmolytic—a property which, however, had no relation to the degree of leucocytosis, and apparently is not dependent on a specific "isosensibilisatrice" (isointermediate body), but to toxins derived from the diseased conditions.—F. P. G.

Experimental Coccidial Carcinosis.—BRUANDET (*La Presse Médicale*, April 26, 1902, No. 34), in working with two forms of rabbit coccidia, namely, the coccidia oviforme of the liver and another coccidia which occurs in cysticerci—probably coccidia perforans—has found several interesting points in regard to their reproduction. Shattock and Ballance had tried in vain to reproduce coccidia oviforme in both the dog and the rabbit by subcutaneous, intrapleural, and intravenous inoculations. According to Bruandet, the failure was due to the fact that the coccidia are dependent on an epithelial nidus for their growth. The simultaneous injection of epithelial cells will not accomplish this purpose, but the author has found that they may be readily reproduced by inoculating them in the rabbit's ureter in a direction toward the bladder, with a ligature above to prevent expulsion. A few days later the kidney may be inoculated. In both kidney and bladder small masses of epithelial cells which contain coccidia are found after twenty or thirty days. Similar lesions may be produced in the testicle.

The deduction which the author draws is that epithelial parasites are dependent on an epithelial surface in order to reproduce. The experiments with coccidia he regards as of great importance on account of their relation to the cause of carcinoma.—F. P. G.

On the Extension of Tumor Metastases in the Lung.—ADOLPH TRENTLEIN (*Cent. f. Allg. Path. u. Path. Anat.*, 1902, Band xiii., No. 13, p. 520). A demonstration of the so called "Kohnische Porenkanälchen" through the alveolar septa of the lung was well given in the present case by the extension of a metastatic sarcoma from the lumen of one alveolus into another. In the gross examination a section through the lung showed numerous tumor nodules varying from the size of a hazelnut to that of a walnut. Microscopically the tumor proved to be a spindle-celled sarcoma which invaded the lung, not through the vessels, but through the perivascular and peribronchial lymph-channels. From the lymphatics the growth spread into the alveolar spaces, completely filling them, but at the same time leaving the alveolar walls intact, so that the author likens the process to a "sarcomatous pneumonia." In thin sections single sarcoma cells could be traced through the septa from one alveolus into another, thus explaining the peculiar intra-alveolar growth of the tumor, and demonstrating, so the author believes, pre-existing openings through the alveolar walls.—W. T. L.

Leucocytosis after the Use of Digitalis in Pneumonia.—A. BORINI (*Central. f. Bakt. u. Par.*, 1902, Band xxxii., No. 3, p. 207). Attracted by the favorable results obtained with digitalis in the treatment of pneumonia, Borini made experiments to determine the protective property of digitalis and aleuron, both hyperleucocytosis producers, when given to rabbits inoculated with virulent cultures of pneumococcus. It was found that the animal

which had received injections of digitalis lived several hours or even days longer than either the control rabbits or those given aleuron. Definite quantities of the drugs and of pneumococcus cultures were injected according to the weight of the animals. Both aleuron and digitalis, harmless in themselves to animals, produced a marked leucocytosis, but they differed essentially in the fact that after the injection of aleuron the hyperleucocytosis was quickly followed by a leukolysis and finally a hypoleucocytosis, while with digitalis the hyperleucocytosis was sustained for a comparatively long period. To these facts was attributed the favorable action of digitalis and the failure of aleuron to prolong the life of the animals.—W. T. L.

HYGIENE AND PUBLIC HEALTH.

UNDER THE CHARGE OF

CHARLES HARRINGTON, M.D.,

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Is Typhoid Fever Sometimes Air-borne?—In support of the theory that typhoid fever may be air-borne, QUILL (*British Medical Journal*, February 15, 1902) gives an account of the circumstances which obtained in a military camp in the hills of Ceylon, where large numbers of Boer prisoners were confined. An epidemic of typhoid fever developed, and no less than six hundred cases occurred. The water-supply was analyzed chemically once a week, and was examined bacteriologically with frequency. No fresh milk was allowed in camp. All carbonated water used was from the same source as that supplied to a neighboring sanitarium, in which no typhoid fever occurred. No uncooked food of any description was used, and peddlers of all kinds were rigidly excluded from the camp. All persons leaving the grounds, for any purpose whatever, were required to carry with them a bottle of filtered water. Since these sanitary regulations were enforced thoroughly, Quill believes that the infection was air-borne from an adjoining camp of prisoners, where the disease prevailed, although the possibility of transmission through the agency of flies after visiting specifically infected latrines must be borne in mind.

VAUGHAN (*Journal of the American Medical Association*, April 19, 1902) also believes that dissemination of the typhoid fever bacillus in dust through the air has been clearly demonstrated, but he believes that the most important means of dissemination of the disease is specifically polluted drinking-water. Frequently the infective agent is carried on the hands and clothing of nurses and other attendants. It is his belief that the disease is never spread by exhaled air, although the organism may exist in the sputum.

JEHLE (*Wiener klinische Wochenschrift*, February 27, 1902) has found the bacillus in the sputum of cases of bronchitis with no lesions of the intestine, which suggests the possibility of inhalation with dust.

In the opinion of TURNER (*British Medical Journal*, February 15, 1902) it is a mistake to attach very great importance to wind and flies in the

causation of epidemics of typhoid fever. His experience of six years in South Africa has led him to believe that, in the great majority of cases, the cause is to be found in a polluted water-supply. He does not deny the possibility of air-borne typhoid, but points out that if dust infection were a predominating or even an important cause of typhoid fever, one would expect to find the disease most prevalent from shortly after the beginning of the dusty season until shortly after its close; but he notes, as a matter of fact, that it is during this very period that typhoid fever is least prevalent. On the other hand, it is during the wet season, when, on account of heavy rain, there is no dust, that the disease is most prevalent. Although conceding the possibility of the transmission of typhoid fever by flies, he points out that, in South Africa, flies begin to be troublesome long before typhoid fever prevails, and continue to be so long after its subsidence. In answer to the criticism that typhoid fever prevailed among the British troops in spite of the fact that filters were provided, he asserts, of his own knowledge, that the filters were not generally used, and that where the commanding officer of a regiment enforced the use of filters the number of cases in that particular body was insignificant.

SCHÜDER (*Zeitschrift für Hygiene und Infectionskrankheiten*, Band xxxviii., p. 343) has collected reports of 650 epidemics of typhoid fever in all parts of the world, of which 377 occurred in Germany, 140 in England, and 66 in France. It appears that 70.8 per cent. of these were due to contaminated water, 17 per cent. to contaminated milk, and 3.5 per cent. to other foods. In reality, water as a cause preponderated even more than is here shown, since even among those attributed to milk and other foods, as oysters, etc., it is probable that in some instances a polluted water may have been a contributing if not the main cause. Speaking also of the transmission of the disease from person to person, he takes as a measure of the danger the relation between the whole number of cases in certain hospitals and clinics and the number of cases occurring among the nursing staff and among other patients. Of 35,647 cases of the disease, 1179—that is to say, 3.3 per cent.—occurred among the nursing staff and other patients; of 23,554 cases in the Prussian military hospitals during the period 1881–1897, 1012, or 4.3 per cent., were among the personnel of the hospital; and 478—that is to say, 2 per cent.—among patients who were present on account of other sickness. The vehicle of infection is chiefly the discharges, and particularly the urine, of those sick and convalescent. He recommends the protection of the nursing body by antityphoid inoculations, according to the method of Marsden and Wright.

Preservation of Meat by Means of Borax.—VAUGHAN and VEENBOER (*American Medicine*, March 15, 1902, p. 421), experimenting with borax on meat, found that meat not treated with borax, and kept at ordinary temperatures, becomes slimy within a few days. From the surfaces of specimens so kept they isolated twenty different species of micro-organisms, fourteen of which were peptonizing bacteria. Inasmuch as it is the usual practice to wash meats so treated as soon as they arrive at their destination, they see no objection to this use of borax; and it would appear reasonable and proper to allow the practice, provided the preservatives do not pene-

trate the meat to any considerable extent. Since the announcement of the German Government of its intention to enforce, on and after October 1, 1902, the law prohibiting the importation of meats to which borax or any other of a number of preservative salts has been applied, Virchow, who is very strongly opposed to such action, has made known that for years he has taken a daily dose of borax with apparent benefit, and that since reaching his eightieth birthday he has doubled the dose.

The law goes much further than merely to prohibit preserved meats. It deals most minutely with the whole subject of slaughtering and meat-inspection. One of the sections regarding the importation of dressed meats requires that they shall be in the form of whole carcasses. Carcasses of hogs and beeves may be split, but the halves must be left together, and must be accompanied by the head, lungs, heart, and kidneys. Cow beef must be accompanied also by the udder, and the carcasses of hogs must include the tongue. No piece of meat preserved by any of the permitted processes shall be allowed entrance if it weighs less than 4 kilogrammes (8.8 pounds), except hams, bacon, and intestines.

Tuberculosis, Human and Bovine.—Koch's denial of the identity of human and bovine tuberculosis has not passed unchallenged in Berlin. MAX WOLFF has induced the *grapes* or *perlsucht* in a calf by inoculation with materials taken at the autopsy of a patient in the wards of Professor von Leyden, suffering from primary ulcerative intestinal tuberculosis, with miliary granulations on the peritoneum and in the spleen, but without any lesions in the lungs or bronchial glands. In another experiment, in which he used the sputa of a tuberculous patient, the results were somewhat equivocal; and Möller failed altogether in his attempts—whether by inhalation, injection, inoculation into a wound, or injection of human tubercle in the form of living cultures—to excite general tuberculosis in the ox, the infection remaining localized when it occurred at all.

[But no number of negative results can disprove well-established positive cases so clear as to present all the conditions of experiments proving the communicability of tuberculosis through the milk of diseased cows. Such was the case of the thirteen previously healthy girls in the school of Les Dames Ianches, at Chartres, reported by Dr. Ollivier; and Dr. Nocard's, of the daughter of a medical man at Berne—a remarkably fine girl, who died of extensive primary intestinal tuberculosis. In both these instances the infection was clearly traced to the consumption of milk from cows with tubercle of the udders. Dr. Koch has found that bovine tuberculosis is more virulent than human to rodents and monkeys, and why not to man also? The bacillus acquires greater virulence in the bodies of some animals and loses it in others, and all that Koch has proved is that the cow has little to fear from man, while man has much to fear from her—more, indeed, than from his own kind. This phenomenon may be connected with difference of body temperature, that of the cow being normally 101° to 102° F.; and in the one recorded instance of tuberculosis in fish it was found that the bacilli had lost all virulence to warm-blooded animals, though originally derived from a human source.—E. F. W.]

Benzine-poisoning.—Dorendorf (*Zeitschrift f. klin. Med.*, Band xliii.) reports two cases of poisoning by benzine among the men in cable and india-rubber works. One suffered from violent pains in the muscles and joints, especially on the right side, which he had ascribed to chronic articular rheumatism. Improving during his stay in the hospital, he returned to the works, where he was employed in the process of vulcanizing; but the symptoms soon reappeared in an aggravated form, with headache and anorexia, compelling him to seek readmission to the hospital. In addition to the former symptoms he now complained of loss of memory, difficulty in speaking, and a sensation of extreme cold in the limbs of the right side, while the pains were exacerbated from time to time in violent crises having their seat in the bones. Careful examination showed loss of muscular power, markedly greater on the right side than on the left, and an appreciably lower temperature on that side. On the same side the brachial plexus, median, radial, ulnar, tibial, and peroneal nerves were painful on pressure, but on the left the ulnar only was so. There was no wasting of the muscles, and no change in the electric reactions of muscles or nerves or in the sensibility of the skin. The reflexes of the knee-joint were exaggerated. There were tremors of the hands, tongue, and eyelids, and nystagmus. After two months he left the hospital, cured.

The other patient was a turner, but working in a room where vulcanization was carried on. Very shortly after entering the factory he began to complain of loss of appetite, vomiting, headache, sleeplessness, and alternations of constipation and diarrhœa, which he ascribed to the vapors given off in the moist vulcanizing process. Admitted to the hospital as a case of gastro-enteritis, he was found to exhibit the same symptoms, with the like unilateral distribution, as the other. A close examination of the several departments and rooms in the factory led Dr. Dorendorf to the conclusion that the inhalation of the vapors of pure benzine, in such proportions as were present there, did not give rise to toxic symptoms, but that these were caused by the use of an impure article containing an admixture of carbon sulphide.

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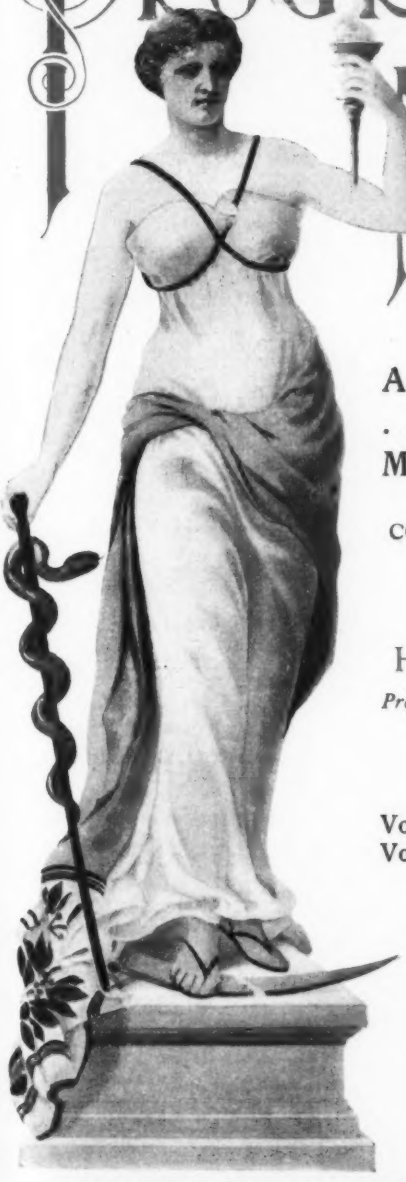

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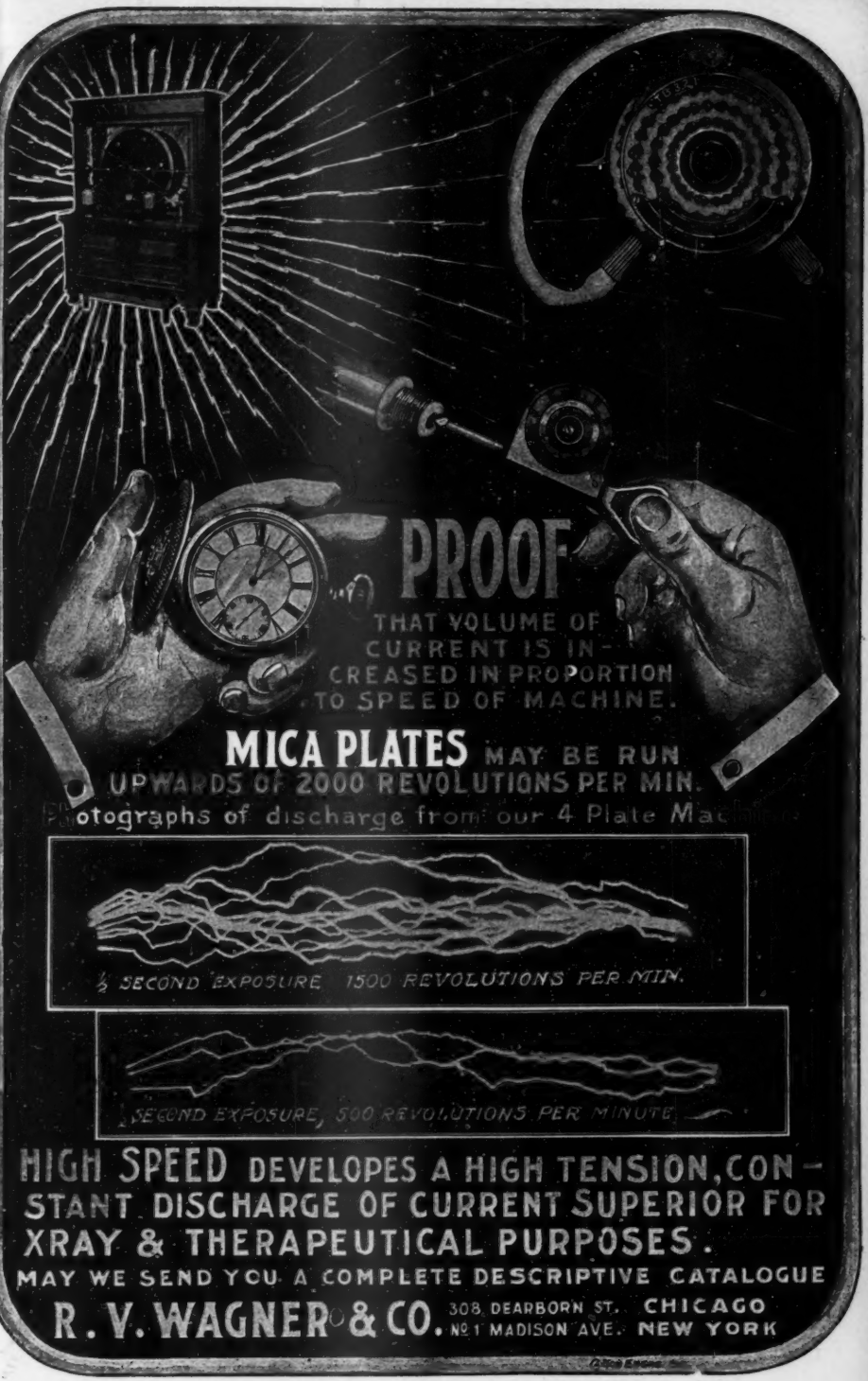
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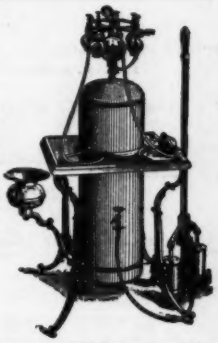

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